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# HANDBOOK

OF

# DISEASES OF THE SKIN

EDITED BY


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PROFESSOR OF CLINICAL MEDICINE IN MUNICH

EDITOR OF

ZIEMSSEN'S CYCLOPÆDIA OF THE PRACTICE OF MEDICINE


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# AMERICAN PUBLISHERS' PREFACE.

It was confidently expected when v. Ziemssen's "Cyclopædia of the Practice of Medicine" was completed, that this volume on Skin Disease would be ready for publication at an early period. Various causes appear, however, to have delayed the issue of the German edition until the latter part of last year.

In the present translation, it has been endeavored to condense the original as much as possible, without loss of clearness or the meaning of the authors, in order to be able to include the whole in one volume of convenient size. Its shape and general appearance have been made somewhat different from ordinary medical publications, to distinguish it as a book prepared expressly for presentation, and not as a commercial venture.

It may not be amiss to state that there is no precedent for the publication of a book of this high character and size for free presentation, to many thousand persons. We trust that the pleasure we have in thus manifesting our appreciation of the generous support accorded to our publications by the medical profession will be shared by those to whom we have the honor of presenting a copy of "Ziemssen's Handbook of Diseases of the Skin."

WILLIAM WOOD & CO., *Publishers.*

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# ANATOMY AND DEVELOPMENT

BY

DR. PAUL G. UNNA.

TRANSLATED BY DR. W. T. ALEXANDER.

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*Development of the Skin as a Whole.*—The corium constitutes the real foundation of the skin. It develops from a superficial layer of the mesoblast which Remak therefore called the skin-plate, and in the second month of fœtal life still consists entirely of round and spindle-shaped cells, with but little intercellular substance. In the third month, in consequence of the appearance of large quantities of fibrillary tissue, an inner layer becomes separated from it, and at the same time the boundary-line between it and the epidermis (which is geneticallly an entirely distinct structure) becomes more sharply defined in the shape of a light, but never double-contoured border. This inner layer is at once transformed, by the deposition of fat in its substance, into what afterwards becomes the subcutaneous tissue. Embryologically, however, it belongs wholly to the corium. The outer layer of the corium remains in an immature condition until the second half of fœtal life, fibrillæ making their appearance between the cells, at first very slowly, growing from below upwards; then vessels, and finally nerves appear. The most superficial portion of the corium, which forms the foundation of the subsequent papillary layer, consists, even at birth, of young granulation tissue, with very few fibrillæ, while the cutis proper has at this time already acquired considerable thickness and density, in consequence of the continuous deposition of collagenous substance between its cells. As the papillary layer, even in the adult, differs greatly from the cutis proper in its richness in young connective tissue and the arrangement of its fibrillary frame-work, and is characterized by certain peculiarities of circulation and the presence of terminal nerve apparatus, we would have at least the same right to regard it as distinct from the cutis as the subcutaneous tissue (hypoderm, according to Besnier). It is, however, more judicious to make neither of these distinctions. Embryology teaches us to recognize only two layers of the skin, the epidermis and cutis (corium). The subcutaneous tissue owes its recognition as a distinct layer only to the circumstance that, in consequence of the macroscopically appreciable de-

position of fat in it, a distinct border-line is visible even to the naked eye, while the equally important border of the cutis proper towards the papillary layer can be made out only by means of the microscope.

Does this mode of development give us a right to believe, with Holt C. Wilson, in a one-sided growth of the corium outwardly towards the epidermis? Assuredly not. We can only say that the entire corium matures from within outwards. And this is perfectly natural, since the vessels grow into the skin from within. It is, however, much more probable that the skin in all its parts continues to grow by cell-division and the formation of new intercellular substance than that its marked increase in thickness during the second third of fœtal life is due entirely to deposits upon its surface.

*Subcutaneous Tissue.*—The subcutaneous tissue is, however, not only the earliest portion of the skin to attain its full development, but even during fœtal life it increases in extent more than any other portion of the skin, and that in consequence of the steady and very regular deposit of fat-tissue in it. After birth, the fat gradually decreases in quantity, and finally remains in exceptional abundance only at certain points of predilection. Other portions of the skin, such as the eyelids, the ear (except the lobule), the external auditory canal, the nose, etc.; in short, portions of the skin which are either firmly attached or are unusually movable or pliable and at the same time muscular, are free from fat in the adult. In addition to the fat, the subcutaneous tissue contains all the larger blood-vessels, lymphatics, and nerve-trunks destined for the corium. In certain parts of it are found the mysterious corpuscles of Vater (see below), and during the course of post-fœtal development mucous bursæ are formed over projecting points of bone, such as the chin, angle of the lower jaw, pomum Adami, olecranon, on the patella, the line of junction of the sacrum with the coccyx, etc. When the fat disappears from the panniculus, the subcutaneous tissue becomes an extremely loose network, the coarser connective-tissue bundles of which are continuous with those of the cutis proper and in many places also with those of the underlying fasciæ and periostea. At such points, the connection of the entire corium with the underlying tissues is a very firm one, as on the head, the palms and soles, etc. On the trunk, the arms and legs, the neck, scrotum, penis, and the eyelids, on the other hand, the connection is established only by means of loose connective tissue and the ingoing and outgoing bundles of vessels and nerves, for which reason the skin is freely movable over the underlying tissues.

The subcutaneous tissue has therefore, on the whole, a purely mechanical importance. It effects the connection between the body and the corium, and serves as a place of deposit for the fat.

*Development of the Cutis Proper.*—The further development of the cutis proper is effected simply by the continuous deposition of collagenous substance, by which its cells are more and more widely separated. The form and direction of this deposition is, however, not accidental, but is very definite and different in each part of the body. The skin, as the outer covering of the entire body, is forced to follow it in its great increase in bulk, and is therefore kept in a state of permanent tension. This exerts a directing influence upon the longitudinal axes of its cells, even while the skin is still in the cellular stage. In addition, the in-growing vessels influence the cells nearest them, to arrange themselves along their own independent paths. As we may regard both the trunk and extremities of the embryo as short, thick cylinders, the relation in them of the circular growth of the skin to that in a longitudinal direction is about as $3(\frac{1}{4}) : 2$, presupposing a similar linear extent of the longitudinal and transverse axes of the individual sections of the body. The longitudinal axes of the spindle-cells of the skin, yielding to the stronger

traction, will consequently arrange themselves at right angles to the longitudinal axis of the trunk and extremities. This I have indeed found to be the case on the finger of a fœtus of two months. It does not then seem remarkable that the secondary deposition of fibrillary tissue should also take place in mainly transverse lines. This course is still followed by the bundles of fibrillæ after birth. In consequence of the extension of the flexed extremities after birth and the growth in length which now begins to preponderate, many of these lines are changed from a transverse into a spiral or longitudinal course. These alterations take place mainly in the neighborhood of the elbow, hip, and knee joint, on account of the new position of the body (Langer). Other changes in the direction of the fibrillation occur during infantile growth, in consequence of alterations in the parts under the skin (disappearance of the fat-cushion, increase in size of the muscles). In the adult, there finally results a typical arrangement of the bundles of fibrillæ for each region of the body.

*Texture of the Corium. Fibrillary Tissue.*—It follows that the skin by no means uniformly incloses the organs of the body like a sack. But there is no ground for the opinion that all the bundles of fibres of the corium have their ultimate origin in the fasciæ, in which case the corium would really be only a repetition of the muscular fasciæ. We find that the skin, on the contrary, bears two entirely distinct relations to its underlying structures. At the above-mentioned points, where the skin is firmly united with the aponeurosis, it resembles a true cushion. As such, it lies without tension over the underlying structures, but slightly movable in consequence of numerous points of attachment, and thickened by an abundant accumulation of fat, especially on the head, the palms of the hands, and soles of the feet. Starting from these points, it extends over the entire surface of the body, $1\frac{1}{2}$ sq. meter in extent, being comparatively movable, and under an universal, everywhere varying tension. Here it resembles neither a sack nor a cushion, but a tight-fitting elastic garment. Its general mobility is interfered with only at certain limited points, by punctate or linear adhesions. Besides, on all the larger vascular and nervous trunks of the skin such adhesions are found at those points where it passes over certain bony prominences, cartilages, and tendons, as the spinous processes of the vertebræ, the crests of the ilia, etc. Only at these and at the above-mentioned points of adhesion to flat surfaces can one imagine the skin to spring from the fasciæ. But it is more nearly correct to regard the fibrillary bundles of the skin as arising free in the connective-tissue septa of the subcutaneous cellular tissue, and as passing more or less obliquely to the surface of the corium; a constant termination and beginning of fibres, which follow the same course, taking place meanwhile. This produces, it is true, the appearauce of large uninterrupted stretches of fibres, a simple view of the matter which possesses a certain advantage in enabling one to obtain a general notion of the subject.

If we look at it in this light, we find that these coarse stretches of fibres in all parts of the body cross others running in other directions, thus inclosing continuous rows of oblong rhombi. At certain points these assume a typically diagonal direction. This arrangement explains why in most parts of the skin not a round hole, but linear clefts are produced by the puncture of a round awl.

*Cleavability and direction of Cleavage.*—When, as is usually the case, the fibres running in one direction are much more numerous than those running in other directions, only linear clefts are produced by the awl, and the skin is, as Langer calls it, completely cleavable. But when, on the other hand, the number of fibres running in different directions is about equal, the application of the round awl produces triangular or ragged holes. In that case an incomplete or indefinite cleavage is said to prevail. Such a condition is found, *e. g.*, on the forehead and on many points of the skull, on the scalp, the chin, the epigastric region, below the olecranon, etc.

By arranging the punctures, which were made close together in rows, Langer ascertained the direction of the stretches of fibres characteristic of each region, and found

that as a rule such fibres descending on the trunk in the form of girdles, obliquely from above and behind, forwards and downwards, run specially around the extremities, for longer or shorter distances.

*Folds of the Skin.*—He also found that the tension of bundles of fibres could never be directly overcome by flexion and extension of the joints, because they always run transversely or obliquely over these parts. For this reason the bundles of fibres are never put on the stretch in the ordinary movements of the joints. The rhomboidal meshes are, however, extended laterally, and the bundles of fibres on the opposite side of the joint are crowded together. In this way are produced not only the permanent folds of skin on the extensor surfaces of the joints, but also the furrows and wrinkles which occur on the forehead, eyelids, scrotum, and around the mouth, as the result of frequent muscular traction, and it is evident that the direction of all these folds will roughly represent the direction of the fibres in that particular portion of the skin in which they are found.

This is also the case with *the folds of emaciation*, which are the result of an excess of skin remaining after the disappearance of the cushion of fat; as the fibres were formerly spread out laterally, not extended longitudinally, the folds which are subsequently formed, of course, correspond to their original direction. This useful avoidance of too great a degree of tension of the collagenous tissue on one side, and of an excess of skin on the other side, in the ordinary movements of the joints is a natural consequence of the fact that the direction of a tissue with rhomboidal meshes may be changed by traction or pressure exerted mainly in a diagonal line. We avail ourselves of this possibility, to use a familiar illustration, when we apply an elastic bandage cut on the bias out of tissue woven on the square. In places with a well-marked direction of cleavage, the preponderating line of tension of the meshes of the tissue is a permanent one after the part has attained its full growth. In places where the cleavage is not well-marked, *e. g.*, on the abdomen, the texture of the tissue of the corium subsequently undergoes permanent alterations, in consequence of changes in the contents and in the bulk of the viscera. These should be carefully distinguished from transient alterations in the direction of tension and cleavage. Similar changes in the arrangement of the meshes of the corium are also often met with in certain pathological conditions, such as cutaneous and deep-seated tumors, subcutaneous abscesses, etc., even in parts with complete cleavage.

*Furrows of the Skin.*—While the folds of the skin are always associated with an excess of tissue, however slight, coarse furrows mark some of those spots which are very closely united by short bundles of fibres with the underlying structures. Such are the furrows utilized in fortune-telling, between the prominences of the palm of the hand, the dimples on the cheeks and chin, and the similar but larger depressions over the points of the crests of the ilia, the sacrum, and their bony projections.

A careful distinction must also be made between these coarse furrows and those much finer ones which occur over the whole body, but are most highly developed on the palms of the hands.

*Voluntary Muscles of the Skin.*—We must also allude to the active voluntary mobility found only on the head and neck of the human subject, in strong contrast with the abundance of skin-muscles possessed by other animals. It is produced by striated muscles which radiate obliquely from below in the fibrous network of the skin, and effect the large class of mimic movements.

*Histology of the Corium.*—The frame-work of the corium in the adult consists microscopically of a fibrillary connective tissue with but few cells, the individual bundles of which, in excised portions of the skin, run in graceful wavy lines, whereas in the living subject we must imagine all the strands of fibres as in a slightly stretched condition.

The cells are found in greatest number in the immediate vicinity of the larger vessels, while everywhere else they are equally scanty. The corium itself has no capillaries. The cells lie upon the bundles of fibres as flat nucleated plates, which send out flat processes between the finer bundles of fibres. We must regard this cellular covering as an almost complete carpet, surrounding the bundles of fibrillæ, in which the small number of the cells is compensated for by their enormous dimensions. According to this view, the cells which are from the first in contact with each other are not entirely isolated by even the most extensive deposit of collagenous substance, and their lines of union must therefore be capable of staining by nitrate of silver over a large extent of surface. It cannot be denied that this view presents a certain degree of improbability in the case of certain pathological products, such as keloids and other fibromata poorly supplied with cells; at any rate, this subject needs a new investigation, as regards the corium.

Certain minute and larger spaces remain between the bundles of fibres clothed with their endothelial sheaths, which represent in their finest ramifications the beginnings of the lymphatic channels. In the normal condition they are of extreme tenuity, but readily assume considerable dimensions at every arrest of the circulation of lymph, and at every parenchymatous congestion. The exact notion which one has of these lymphatic roots will depend, in the first place, upon the question whether or not the cellular carpet is everywhere continuous, and in the second place on the just as little settled question of the cement substance of the corium.

*Cement Substance of the Corium.*—The existence of such a substance is demanded both by histologists and physiologists. Flemming describes it as an ill-defined mass, in which the bundles of fibrillæ are enveloped as in a cloud. The familiar transverse rings of the bundles of fibres, which are easily produced artificially, are said to be due to its contraction. According to this view, the lymphatic roots would, perhaps, be more accurately defined as "fissures of the cement-substance." This substance has already been physiologically made use of by Langer to explain the decided retraction of the skin which often occurs. Tomsa thinks that the cement substance holds the fibrillary frame-work and the other elements of the skin together, and is the cause of the elasticity of the fresh skin.

While we are, therefore, sufficiently instructed by Langer's investigations concerning the anatomical basis of the great extensibility of the skin, and must seek the larger part of it (primary tension) in the alteration of the rhomboidal mesh-work into one in which the fibres are more nearly parallel, and a much smaller part in their complete unrolling and final over-extension, we can at present offer no adequate explanation of the cause of the rearrangement of the tissue, by which it shows its complete elasticity.

*Elastic Tissue.*—It is certain, according to Tomsa's experiments, that the elastic tissue plays a very insignificant part in bringing about this rearrangement. The elastic fibres are very evenly scattered through the framework of the skin, and surround the collagenous bundles completely. When isolated, the elastic framework shows, however, a very slight degree of retractility, and it cannot, therefore, account for that of recently excised skin. But as it becomes much less swollen in the alkaline fluids of the tissues than the collagenous substance, it must necessarily, according to the quantity and composition of the surrounding fluids, exert a more or less great, but at any rate an appreciable tension upon the latter (Stirling). Its even and universal distribution must also bring it to pass that impulses of traction and pressure, exerted at certain points, must, radiating from these, be felt over a large part of the vicinity. The whole significance of the elastic constituent of the skin can be placed in the right light only by considering its relations to the involuntary muscles of the skin, to which we shall, therefore, next turn our attention.

*Involuntary Muscles of the Skin.*—Although these muscles operate in a very unobtrusive manner, they nevertheless are among the most important regulators of all the functions of the skin. They are of three kinds.

*Muscular Membranes.*—They attain their greatest size in the "muscular membranes" found in the scrotum, penis, mammary areolæ, and nipple. Here the bundles of smooth muscular fibres are deposited in layers in the corium, lying almost perpendicular to the direction of its cleavage. In the scrotum, where the rows of fissures run in a curved manner from the root to the raphe on either side, the bands of smooth muscular fibres are arranged parallel to the raphe, the longest below, the shortest nearer the surface (Tomsa). On the penis, nipple, and areola they follow a circular direction nearly at a right angle to that of cleavage, which is obliquely longitudinal in the former, and radiating in the two latter.

Similar to these concentric muscular shells is a radiating muscle, the smooth lid-muscle of Müller, which should be regarded as the involuntary antagonist of the orbicularis palpebrarum. All these muscles throw the skin into folds when they contract, which folds indicate the direction of cleavage in that particular region. Their relaxation, therefore, causes no extension of the bundles of fibrillæ. The muscular membranes have, therefore, less to do with the contents of the corium than with the external configuration of the skin.

*Arrectores.*—It is otherwise with the so-called "arrectores pilorum." These are so arranged that, originating with several tips from the papillary portion of the skin, they become inserted by a number of blunted ends into the middle portion of several adjoining hair-follicles. This fusion of different muscular bundles into one arrector should moreover be regarded as an acquired peculiarity, since in the fœtus every primary hair is provided with a separate muscular bundle. As we may regard the hair-follicles (incorrectly from an embryological standpoint) as involutions of the papillary layer (Tomsa), we find that the arrectores unite two points of the papillary layer, situated at different levels as regards the corium, forming at the same time loops around a part of the latter. The first effect of their contraction is therefore the approximation of these points of the papillary layer, *i. e.*, the erection of the hair, and the drawing inwards of a point on the surface. But the action of these muscles is much more general, and is especially exerted upon the contents of the corium. The muscles are in fact not only surrounded, but also traversed by a network of elastic fibres, and elastic threads pass out all over their surfaces which lose themselves in the general fibrous frame-work. At both ends of the muscles, these elastic threads arrange themselves in large bundles, which act as a tendon for the attachment of the muscles to the fibrillæ of the corium. Their contraction, therefore, produces a tension of the entire surrounding elastic frame-work, and as in the action of involuntary muscles large spaces are always simultaneously shortened, the contraction of these muscles produces a general shortening and condensation of the corium. Of course, the portions of skin nearest the muscles are most powerfully affected. It is, therefore, evident that the sebaceous gland will be relieved of its contents (Sappey) by the erection of the hairs and the opening of the funnel of the follicle (Hesse). The bundles of the corium situated above the arrector are directly compressed by it, and as they in part belong to ascending transverse bundles, this tension is transmitted over a large surface (Tomsa). But as in many parts of the skin the direction of the hairs corresponds to that of the cleavage, *i. e.*, the direction of the principal bundles of fibres, this remote action is probably not so important as the general tension of the elastic frame-work first alluded to.

*Relation of the Arrector to the Hair.*—Tomsa is right in insisting that we should

regard the attachment of the muscles to the hair as the relatively fixed point, and that to the papillary-layer as the movable one. It is thus easy to understand how muscular irritation of medium severity is not followed by erection of the hairs, but only one of the

FIG. 1.—General view of the skin of the new-born child, arteries injected with carmin-gelatin, hardening with alcohol, staining with hæmatoxylin. *h*, horny-layer; *k*, granular-layer; *st*, prickle-layer; *g*, excretory duct of the coil-gland; *t* sebaceous gland; *pf*, productive epithelial process; *h h*, hair-bed; *b h*, bed-hair (hair with a full root); *k n*, coil-gland; *c*, cutis; *sf*, subcutaneous fat-tissue; *cf*, cutaneous columns of fat which ascend from the subcutaneous fat-tissue into the loose perifollicular tissue, and send lateral branches in the direction of the coil-glands; *sa*, large subcutaneous artery; *sn*, large subcutaneous nerve; *sf*, fat-tissue, lying by the side of a large subcutaneous vessel with short lateral branches.

greatest intensity. Tomsa defines the action of the arrectores to be as follows: with the aid of the frame-work of the skin, which is drawn in the opposite direction, they definitively fix the bottom of the follicle to which they are attached, and turn towards them-

selves, upon its bottom as a fulcrum, the nearest hair-follicle towards which their papillary end is turned, and which is also in a fixed position. Although this explanation is correct as applied to regions with a thick covering of hair, it is by no means adapted to those parts of the body in which the hairs are widely separated from each other, as a glance at Fig. 1 teaches; but the same Fig. 1 also shows that the retraction of the papillary layer by the arrectores must at once produce a lessening of the quantity of blood in the terminal loops of the vascular plexus.

The general compression of the skin begins, therefore, at its periphery; the papillary layer becomes pale and anæmic. The view that the arrectores have no absolutely unalterable relation to the hair-follicles is supported by the fact that many hairs have no muscles attached to their follicles, viz., those of such regions as are richly supplied with other smooth and striated muscles. It is evident that these muscles, such as the musculi palpebrarum, may perform all the functions of general tensors of the corium.

*Diagonal Muscles of the Corium.*—On the other hand, in many parts of the skin, particularly in those with indefinite cleavage, a large number of smooth muscles are found ascending obliquely in the corium, which possess an importance entirely analogous to that of the arrectores as regards their action on the corium, but which form no attachments to the small follicles of the downy hairs of these parts.

*Oblique Tensors of the Corium.*—In looking over the facts already brought forward, it seems most convenient to group together, in contrast to the muscular membranes, the *horizontal tensors*, the arrectores of the hairs, and the free diagonal skin-muscles, under the common name of "*oblique tensors of the corium*," without regard to whether they have a fixed point on a hair-follicle or not. It is possible that the firm hair-follicle plays for the oblique muscles only the rôle of certain long projections for the striated muscles which pass over them, that of furnishing new points of origin for them. *The real beginning and end of the oblique tensors of the skin is the elastic tissue*, and through it *the entire corium*. Just as the elastic tissue automatically prevents an over-filling of the lymph-spaces with tissue-fluid, by exercising an elastic compression upon the more readily swelling collagenous substance, the skin-muscles scattered through the elastic frame-work are capable with its aid of exerting a compressing force in response to the much more delicate stimulus of sensitive nerves. In the first place, the secretion of the sebaceous glands is pushed outwards into the funnel of the hair-follicle, and blood and lymph are pressed out of the capillaries of the papillary layer and the upper part of the corium downwards into the larger vessels. The secretion of the coil-glands or as much of it as has already reached the excretory duct must also be forced outwards; but upon the coils themselves, which lie in the lower third of the corium and below the muscles, they cannot exert an expressing, but only a retaining influence.

*Tension of the Skin a Function of Temperature.*—The tension of the skin effected by the muscular apparatus and the elastic frame-work is largely under the control of the *temperature*. As can be beautifully seen on the large muscles of the tunica dartos of the scrotum, a moderate condition of tension corresponds to a medium temperature, complete relaxation to greater heat (*e. g.*, that of a hot bath), and a high grade of contraction to intense cold, manifested in the case of the scrotum by retraction of the testicle against the opening of the inguinal canal, and in hairy portions of skin by the well-known "goose-skin." It will be readily understood that by means of the elastic transmission in all directions the effects of external and internal changes in temperature may be regulated with extreme delicacy—a circumstance which has all the greater significance, in view of

the fact that the muscular apparatus of the blood-vessels which ascend into the corium is but very slightly developed.

*Functional Connection between Elastic Frame-work and Muscles.*—The elastic frame-work is therefore a kind of inhibitory apparatus which, in general, equably distributes pressure and traction, and specially helps the oblique skin muscles contained in it to regulate secretion on the one hand, the circulation of the blood on the other, and in this way to influence the movements of the fluids, nutrition, and the interchange of gases.

*Thickness of the Skin.*—In the infantile skin, the corium is still very thin, whereas the subcutaneous tissue occupies considerable space. This fact accounts for the ease with which furuncular abscesses push it outwards and break through it. The corium of the adult offers a much greater resistance to attacks from within and without. Its thickness is tolerably constant, varying between one and one-half and two mm. An exceptionally slight development of the corium is found in the skin of the eyelids, the external auditory canal, the free border of the lips, the glans penis, prepuce, and the inner surface of the labia majora. In these places, the corium is simply a thickening of the papillary layer, which lies in almost immediate contact with the subcutaneous tissue. It is but feebly developed in the face, the ears, penis, scrotum, perineum, areola of the nipple, and very highly developed over the entire back, the buttocks, and the palms of the hands and soles of the feet (as much as three mm. in thickness). It attains a remarkable degree of development in negroes. The mode of life has an important influence in causing this; the corium becomes especially thick when it is constantly exposed to wind and weather (Krause).

*Senile Changes.*—The senile changes in the corium have been studied by I. Neumann. He found them to consist in part of granular opacities, which, at first appearing as coarse granules, run in rows through the corium, and give it a dull, greenish-yellow tint, and subsequently, in the shape of finely granular masses, entirely supplant the fibrillary tissue, and in part of a gelatiniform, glassy swelling of the bundles of fibres, in which all the nerves and vessels seem to have perished. The muscles also degenerate in the senile skin.

*Development of the Papillary Layer.—The papillary layer* of the skin, as we call the upper part of the corium which borders on the epidermis, is developed in most intimate connection with the epidermis, so that no pathological process affects either the epidermis or the papillary layer alone. Up to the fourth fœtal month, the border line between the two is perfectly straight, but at that time there appear, first on the palms and soles, linear thickenings of the epidermis, which, projecting into the corium, produce groove-like depressions in it, so that from this time on epidermis and corium are dove-tailed together, as it were. In the sixth month, the epidermis becomes thickened over the ridges of the corium which were left standing, and penetrates into them, growing around the more resisting portions. These firmer points of the surface of the corium, which are at first characterized solely by an unusual accumulation in them of young cells, are thus transformed into papillæ, and subsequently receive capillary loops of their own. They constitute the centres of nutrition nearest the epidermis, and therefore play a prominent part in its physiology and pathology. Towards the end of fœtal life, the primary, ridge-like, and the secondary papilla-forming epithelial processes appear on the rest of the skin, but not with the same regularity as on the hands and feet. At birth, the papillary layer has not yet attained its full development.

*Fields of the Epidermis.*—The papillary layer is therefore formed by the growing into each other of the epidermis and corium, the active part being played by the former. The corium determines the form of the papillary layer to a certain extent, owing to the fact that it possesses many resisting lines and points which remain intact in the shape of ridges and papillæ. These spots, which, as a rule, mark the situations of subsequent

blood-vessels, form on the palms and soles regular, parallel, usually crooked ridges, which inclose between them the well-known fine furrows of these parts. On the rest of the body rows and groups of papillæ are divided by deep epithelial processes into distinct fields, which produce an irregular formation of grooves between them. Although the primary epithelial prolongations are formed much too early and superficially to have any connection with the lines of direction of the fibrillary tissue of the corium, the general direction of the epidermic fields produced by them (*i. e.*, the main diagonals of the oblong) coincides, on the whole, with the direction of cleavage of the corium (O. Simon). The fields of the epidermis, which, besides on the hands and feet, are especially well-developed on the joints, the extensor surfaces of the extremities, and the hairy scalp, seem therefore to be subject to the general laws of tension of the skin. Only where well-marked cleavage predominates do they appear distinctly in an oblong form, while on parts with indefinite cleavage they are square, triangular, or irregular in shape.

*Papillæ.*—The papillæ are very irregularly distributed, and vary greatly in shape and size. They have, as a rule, the shape of a blunt cone, being 1½ to 2 times higher than they are broad. Their height varies between 0.05 and 0.2 mm., the latter dimension being attained on the palms and soles. There they are arranged in two rows of simple or compound papillæ, inside the ridges already described, frequently inclosing smaller papillæ between them. They are still more numerous on the clitoris and penis, the labia minora, and the areola of the nipple. In many parts of the body they are entirely wanting or appear only as flat elevations. Mention must also be made of the fact that the surface of the corium, which is plastic to a high degree, accommodates itself to all the changes of the epithelial structures which penetrate it. In consequence of the advance of the epithelial processes into it, the papillæ are rendered longer and narrower, while new ones are formed by the surrounding of new portions of the corium by the growing epithelium. When they undergo atrophic involution, they become shorter and broader, and finally sink again into a level surface, as in old age. During this process, the natural irregularities of the part produce dendritic forms of the surface of the corium, so-called compound papillæ, or flat, mound-shaped figures, and almost completely isolated, globular portions of the corium are sometimes seen.

*Morphological Significance of the Papillæ.*—The custom of regarding the papillary layer as a tissue of permanent form, constructed after a definite plan, cannot stand the test of more careful observation. There is no normal standard for the papillæ of each region of the body, which might perhaps serve as a means of comparison in the employment of the common terms, hypertrophy and atrophy. The papillary layer can be regarded only as an extremely variable border phenomenon, which in each case represents only the relation between the pressure exerted by the growth of the epidermis on one side and of the corium on the other. The only standard for judging pathological conditions is consequently comparison with the adjacent normal skin. There still prevails, however, a tendency to ascribe every change in form of the papillary layer to the sole activity of the connective tissue. The real truth of the matter was first clearly made known by Auspitz in 1870. It is true that an ingrowth of young connective tissue into the epithelium does sometimes occur under pathological conditions. But in such a case the epithelium is always found to be pathologically altered, filled with wandering cells, disarranged, and destroyed. A dendritic splitting up of healthy epithelium by growing connective tissue does not occur in the skin, although it may well be possible after a partial loss of epithelium. At an early period of the development of the sheep, it is true, the striking picture of masses of granulations are found here and there on the head, which push out the still very thin epidermis. But the human epidermis is from the first too strongly developed for this, and too much inclined to local hyperplasiæ. As opposed to all the processes which it sends downwards for the formation of the hairs and coil-glands, the activity of the corium is restricted to this, that it in part from the first diverts the ingrowing epithelium from firm to less resisting

points, and in part afterwards arrests its progress in many places by local hyperplasiæ, which later develop into isolated papillæ (hairs), while other processes press onwards without encountering resistance (sweat-glands). Thus far, the matter is very simple. The only point which demands an explanation is that of the penetration of the epithelium. Why does not the epidermis become thickened in spots externally? Why does it send its processes inwards? The reason for this can be found only in the firmer cohesion which the cornified cells acquire externally; and in fact the inward growth of the epithelial processes occurs in fœtal life only after the epidermis has attained considerable thickness and coherence, and even later on the superpapillary epidermis, as compared with the interpapillary, is so much thicker the slighter the cornification of its cells (condylomata acuminata et lata).

*Histology of the Papillary Layer.*—The internal structure of the papillary layer corresponds to its function as a cushion and filter of nutriment for the epidermis. It represents a delicate piece of felt, the extremely wavy fibres of which arise from the collagenous fibrillary network of the corium. By virtue of this arrangement, every strain which reaches the corium is transmitted to the papillary layer also, being meanwhile converted into a tension of the latter from all sides (Tomsa). A definite direction of cleavage the papillary layer cannot, of course, possess. Preparation is already made, in the uppermost layer of the connective tissue, for the everywhere identical arrangement of the epidermis, without which protecting substratum the latter would hardly be capable of adapting itself to the variations in the tension of the corium. The elastic fibres also penetrate into the papillary layer, in which they are just as evenly interwoven into the collagenous bundles as in the corium. Their principal function is the transmission of the action of the oblique tensors of the skin to the papillary layer.

*Furrows and Ridges of the Papillary Layer.*—The external surface of the papillary layer and its connection with the epidermis is best studied after the careful maceration of fresh skin in citric acid (formic acid), and subsequent staining with gold or osmium. The naked papillæ, as well as the interpapillary grooves and hollows, then show a beautifully wavy system of lines, which remind one of the furrows on the ends of

Fig. 2.—Surface of the Corium deprived of Epidermis.

the fingers (see Fig. 2). That we here have to deal with a system of alternating grooves and ridges is best seen from a profile view. These grooves receive ridge-like projections of the epithelial cells between them, which come from their under surfaces. This accounts for the fact that, on some sections, the layer of epithelial cells nearest the corium is provided with coarse dentations, while, in other places, the border-line is perfectly straight. In the latter case, the section has fallen in the direction of these fine furrows, whereas, in the former, they were cut at right angles. In places not completely macerated, it can be plainly seen that an epithelial cell is welded by its basal ridges into three or four grooves of the papillary layer, an attachment of hitherto unsuspected completeness.

*A Basal Membrane does not exist.*—These fine grooves of the surface do not, however, correspond to connective-tissue fibrillæ. They are rather channelled out of a trans-

parent substance, which spreads over the entire papillary layer in an extremely thin stratum. The presence of double contours nowhere, however, indicates the existence of a membrane. This intermediate substance, which also penetrates into the interior of the papillary layer, and is probably identical with the so-called cement-substance, can be removed by trypsin, and then, with the outline of the furrows, the clear external border of the papillæ also disappears, and the connective-tissue fibrillæ are laid bare, some of them spreading out like a brush, others having the form of loops.

*Papillary Vessels.*—The majority of the papillæ are the carriers of capillary vascular loops running vertically through their centres, the main office of which is to provide for the nutrition of the epidermis, the respiratory function of the skin, and the production of watery sweat. The capillary loop consists of an arterial and a venous branch, which unite a little below the apex of the papilla, and run a straight or a curved course according to the amount of their contents and the retraction of the papillæ. The waviness may attain such a degree that the loop fills almost the whole of the papilla. This allows us to infer a great variability in the length and calibre of the capillary loop in vivo. In some papillæ, a number of arterial branches empty into the venous capillary.

A small proportion of the papillæ contain a tactile corpuscle instead of a capillary loop; in rare instances, a small capillary loop passes up a short distance into the papilla beside the corpuscle.

In close contact with the papillary layer lies the epidermis,[1] although no genetic relation exists between them them. All the attempts which have been made, even quite recently, to demonstrate the origin of at least a part of the epithelial formation from the connective tissue, must be regarded as failures. The epidermis has its own matrix, the ectoderm, and after losses of its substance, is regenerated only in case portions of the ectoderm have been preserved, in the shape of epidermis, hair-papillæ, or ducts of glands.

*Development.*—Consisting originally of a single layer of polygonal cells, it presents in the second month a second row of smaller substitutive cells, which make their appearance between the first layer and the corium. While the outer layer, in consequence of the flattening of its cells, gradually comes to resemble the subsequent horny layer, the lower one gradually becomes thickened, from the third to the fifth months, into one containing from two to four rows of cells, which may already be recognized as the prickle-layer on account of the presence of fine connecting threads between the cells. The increased vascularity of the corium in the second half of fœtal life entails a marked increase in thickness of the prickle-layer. The horny layer, however, remains thin, and at the seventh month has only two rows of cells, the outermost non-nucleated scales mixed with fat, being transformed into the vernix caseosa, or gradually thrown off and mixing with the liquor amnii. As early as the eighth month granular cells make their appearance between the prickle and the horny cells, and a more complete cornification occurs, which puts an end to further desquamation of the epidermis. The thickness of the epidermis (0.15 to 0.25 mm.) is at birth considerable, in comparison with that of the corium (0.7 to 0.9 mm.), when we contrast with it the relation of the two layers in the adult. This disproportion ceases between childhood and the period of puberty, as the epidermis increases but little in thickness. If we also bear in mind

[1] It is to be hoped that the erroneous designation of the horny layer as "the epidermis" may soon finally disappear from scientific works.

that from the fifth to the eighth month all the hairs and coil-glands are developed from outgrowths of the prickle-layer, we gain some notion of the luxuriant growth of this germinal layer at the period mentioned. This quantitative increase is due almost entirely to cell-division, the individual epidermic cell in the adult being but little larger than in the fœtus. In this way proof is also furnished of the astounding productivity of the epidermis, the general surface being one hundred and forty-five times as large in the adult as in the fœtus (Harting). During the fœtal period, the cornification is not of the same hardness in all parts of the body. The horny layer is most unyielding on the dorsal aspect of the terminal phalanx of the fingers and toes, on which the original epidermis, condensed into a membrane, remains as late as the eighth month. This fact has a peculiar significance for the development of the nail. Beginning with the sixth month, the outer layers of the epidermis acquire such a firm coherence that, from this time on, the increased difficulty of its growth in thickness towards the surface no longer suffices, and the proliferating epithelium is driven downwards into the corium at some points. We have already seen how, during this process, certain more resisting portions of the latter are entirely surrounded by the growing epithelium. It now only remains to take a nearer view of the forms of epithelium thus produced. It is not enough to describe the portions of epidermis which penetrate between and give form to the papillæ, as "cone-shaped." It is true that, on transverse sections of the skin, the epithelial processes seem, as a rule, to be conical in shape, but they are also often club, nail, and hump shaped.

*Form of the Epidermis as a Whole.*—In horizontal sections of the skin, however, they completely fill the spaces between the circular cross-sections of the papillæ. Their real configuration is, therefore, a more complicated one; it is the negative of that of the papillæ, and, therefore, a plate with numerous conical depressions upon its under surface.[1] If a vertical section cuts through a row of such depressions, the cut surface presents a corresponding series of conical epithelial outgrowths, but if it falls exactly between these depression, the epithelium, of course, presents a straight outline towards the corium. In places where the papillæ stand in regular rows, it is, therefore, possible to make at will sections with either a wavy or a straight border toward the epidermis. It is evident that great caution is necessary in judging the border-line between the epithelium and the corium in pathological cases; it can with safety be determined only on a continuous series of perpendicular sections after comparison, if possible, with horizontal sections. Just as little can one obtain a notion of the bulk and superficial extent of the epidermis by single measurements of the height of the epithelium between and over the papillæ. Here also the relative extent of the papillary layer and the epidermis must first be determined on horizontal sections, and the cross-section of the papillary layer thus ascertained must be multiplied by its thickness, and subtracted from the cubic contents of the entire epidermis.

It is, however, a different matter with the epithelial processes which are not formed by the growth into the corium of the epidermis in toto, but by further sprouting of single, more highly favored portions of the epidermis, after the papillary layer has already been formed. These assume, without exception, while penetrating into the meshes of the corium, the shape of cones, like the epithelial sprouts from which the sweat-glands and hairs are formed. The process of growth and new formation of papillæ (on the hairs), which continues through the whole of life, is the physiological prototype of the irregular growth of the epidermis in pathological cases (infiltration of the corium, tumors). In such cases, according to the direction in which the section is made, there are

[1] Whence the ancient, inappropriate name rete (Malpighi).

found dendritic and branching conical figures. The surrounding of portions of the corium by the epithelium, however, never goes as far as the complete cutting-off of mature fibrillary tissue, whereas masses loosely embedded in the corium (collections of round cells, blood-clots, heaps of pigment), which do not contribute to the nutrition of the skin, may indeed be completely surrounded, if growing epithelium comes in contact with them.

It follows from all this that the name epithelial cone, which is frequently given to the interpapillary portion of the epidermis also, is inappropriate. But, as a short designation is necessary for those portions of the epidermis which lie over and those which lie between the papillæ, we shall call them the "interpapillary prickle-layer" and the "superpapillary prickle-layer."

*Layers of the Epidermis.*—We divide the epidermis into three layers: 1, the prickle-layer; 2, the granular layer; and 3, the horny layer. The innermost, which is seated directly upon the papillary layer, is the prickle-layer, which consists of so-called pavement epithelium, of an approximatively cubical shape, piled up in a varying number of rows of cells. Close to the border of the corium the shape of these cells is usually cylindrical, for which reason they were formerly distinguished from the rest of the prickle-layer as "cylindrical cells."

*Prickle-layer.*—A little higher up in the epidermis, rounded and cubical cells make their appearance in the interpapillary spaces, and horizontally flattened cells in the superpapillary region. All these cells have as a common characteristic a thick *armor of prickles,* composed of fine protoplasmic processes.

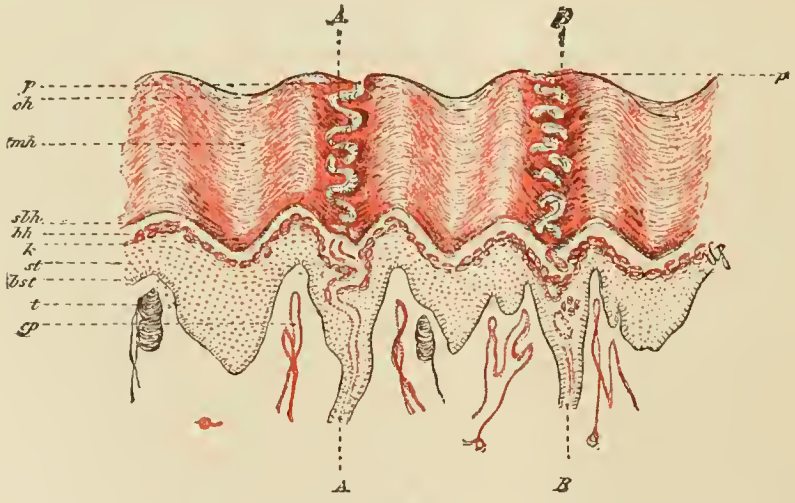


FIG. 3.—Epidermis and papillary layer.—Picrocarmin staining.—Decolorization of the picric acid by alcohol and water. *P*, sweat pore; *o h*, superficial horny layer; *m h*, middle horny layer; *s b h*, superbasal horny layer; *b h*, basal horny layer; *k*, granular layer; *s t*, prickle layer; *b s t*, basal prickle layer (cylindrical cellular layer); *t*, tactile corpuscle; *c p*, capillary loop; *A-A*, *B-B*, excretory ducts of sweat-glands.

The differences in the shapes of these prickle-cells are due as a rule to demonstrable mechanical influences. Thus the cylindrical form of the basal cells is the result of their greater productivity. We here find a constant new-formation of the epithelium by indirect division of nuclei and cells. As the younger basal prickle-cells must of necessity push themselves in between the older ones, all the cells in this part are flattened and narrowed in a direction parallel to the corium, and elongated in one vertical to it. Such is the appearance presented by the basal prickle-layer when the new formation is moderate, particularly when active proliferation is followed by a long period of rest, as is generally the case in the adult. When the growth of the epithelium is very active, on the other

hand, a layer of cylindrical cells is not again formed, for the reason that many of these cells constantly lose their upper halves during cell-division. In this case, the lowermost layer of prickle-cells is filled with several rows of young rounded cells.

We may obtain some notion of the situation and extent of the productive portions of the prickle-layer in the normal and pathological skin by utilizing the property of the mother and daughter cells during their division, of becoming much more vividly stained by good coloring agents than the older prickle-cells in the same sections.[1]

FIG. 4.—Indirect division of nuclei and cells.—Prickle-cells from a condyloma. *a*, coil-like nucleus, *b*, the same with loops partly torn through; *c*, coil-like daughter-nuclei; *d*, star-shaped daughter-nuclei; *e*, star-shaped mother-nuclei; *f*, as *e*, probably an equatorial plate (Flemming).

In order to prove the proliferation of epithelium, it is also essential in the present state of science to demonstrate the occurrence of division of nuclei and cells at the point in question. According to my previous experience, appearances which show this are found in the normal skin only in the lowermost row of cells in the prickle-layer.

The rounded forms of the cells in the middle stratum of the prickle-layer is explained by the tolerably uniform pressure from all sides of the neighboring cells, while two factors exercise a controlling influence in producing the horizontal broadening of the superpapillary prickle-cells. In the first place, the increase in extent of the surface of the body in each successively higher layer of cells makes itself the more felt directly over the papillæ the less it is counteracted by cell proliferation at this point; in the second place, at this level the proximity of the firm, horizontally spread out horny layer is calculated to make these cells assume the shape of thick plates.

The shape of the prickle-cells is, however, not exactly defined by calling them cylinders, cubes, and plates, because all the cells, particularly those in the lower layers, have their surfaces facetted and partially excavated, or rendered angular.

All the prickle-cells are composed of a hollow globular body, which ends abruptly internally, near the nucleus, with a sharp contour, and externally towards the neighboring cells, is covered over and over with fine protoplasmic processes. The nuclei of the prickle-cells are relatively large, so that their thready structure becomes visible with low magnifying powers (Hartnack, VIII.). They contain one or more nuclei, and are not bounded externally towards the body of the cell by a membrane, and are therefore not really vesicular bodies. The nucleus lies in close contact with the body of the cell; the clear space visible between them, in some methods of preparation, is artificially produced. The shape of the nuclei in the upper layers, which are less exposed to the pressure of the neighboring cells, is a regular oval, in the lower layers round or rod-like, according to the shape of the cell, and the long axis of the nucleus in the different layers of the prickle-layer always coincides with that of the cell, except during division.

[1] In order to furnish a good selection to the staining agent, it is necessary (as is advisable in all cases) to afterwards decolorize the over-stained sections; *e. g.*, hæmatoxylin should be removed by momentarily dipping the section into glacial acetic acid, carmine in aqua ammonia, etc.

Max Schultze was the real discoverer of the prickly coat of the isolated cells; he believed that they fitted closely into each other, like the teeth of two watch-wheels. Bizzozero, on the other hand, believed that the prickles of two adjacent cells melted together at their points, and Lott took a middle position, maintaining that the points of the opposing prickles are in contact by their sides. Ranvier finally again inclines to the view of Bizzozero. According to him, the opposing prickles melt together and form an elastic nodule, a peculiar "elastic organ," which permits a considerable lengthening of the prickles.

Seen from the surface, the prickles appear as points, in profile as completely isolated fine bristles usually with pointed extremities. They are attached to the body of the cell at tolerably regular intervals, partly seemingly without regularity, partly arranged in curved, and sometimes in straight lines, the last mainly near the corners of the cells. On isolated cells the prickles seem to vary greatly in length. When examined in connection, places are often found in which no isolated prickles can be seen, but only protoplasmic threads, stretched bridge-like from one cell to another; there is, of course, no point of junction, no "elastic organ." I find such places often enough n the skin of the adult, but always in the skin of the fœtus. Here they form tolerably broad protoplasmic connecting bridges, which leave narrow spaces between them. In the adult, other places are also found in which the prickles are isolated, and alternate with those opposite them, occasionally touching each other with their points, as Lott has described, or melting together at their ends, according to Bizzozero.

In still other cases, and especially where a wandering cell which has crept into the interspinal spaces lies close to an epithelial cell, the prickles of this side of the cell have disappeared for short distances (see Fig. 5), while the opposite cell sends out its prickles freely. Finally we see prickles of very great length, which Ranvier also describes, which unite, not the nearest points of two adjoining cells, but more remote ones, running partly entirely around one, and going over to another.

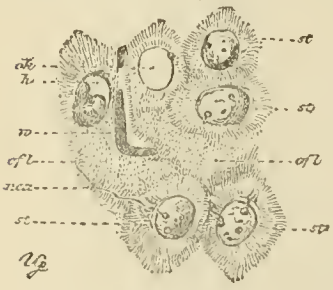

FIG. 5.—Small portion of the prickle-layer, interepithelial terminal nerve branches, and intra-epithelial terminal nerve-bulbs; wandering cells. Section treated with ether, osmic acid, hæmatoxylin, glacial acetic acid. *o f l*, prickle-cells seen from the surface; *o k*, prickle-cell without nucleus, which has fallen out; in the cavity thus formed a terminal nerve-bulb is visible; *n e a*, terminal nerve branch; *s t*, prickle-cells with two terminal nerve-bulbs; *h*, cavity near the nucleus produced by its shrinking; *w*, wandering cell, lying in a dilated interspinal space; a little higher, a fragment.

It will be seen from these different appearances that it is impossible to accept any one of the views given above as the normal standard. The most likely view is to regard the form of the simple protoplasmic connecting bridges as the original one. These bridges are, however, exposed to the influences of the lymph which flows around them, to the ingrowth of nerve-threads, to immigration of white blood-corpuscles, and to the more or less great alterations in the situation of cells which originally lay close to them; we must, therefore, in view of these facts, attribute to them the faculty of being passively, and perhaps also actively, drawn in and out. It is unnecessary to imagine the presence of "an elastic organ" in the threads, which to me seems particularly untenable and superfluous for the reason that short bridges without the intermediate nodules occur just as frequently as long ones which present such nodules in spite of their elongation.[1]

We must, therefore, regard the prickly sheathing of the cells as a system of protoplasmic processes engaged in active movements, which permit the free circulation of the nutritive current through its spaces, and effect an organic connection, very firm, but not inalterable between adjacent cells. The older the prickle-cells in the higher layers be-

[1] Attention must also be paid to the semblance of rows of nodules, in figures resembling the rounds of a ladder. Such are due to nerve-threads which pass under them, and produce optical appearances of bends.

come the shorter are the prickles, and in the succeeding layer of granular cells the connection is always reduced to straight connecting bridges. The prickle-cells can only be isolated with difficulty, the prickles often breaking off rather than yield at their points of union.

*Granular Layer.*—Next to the prickle-layer comes the granular layer, which usually consists of one or two, more rarely three, and in pathological cases of even four or five rows of coarsely granular cells. *It is to this layer alone that the white race owes the color of its skin.* The granules of this layer refract the light very strongly and therefore seem dark by transmitted, and white by reflected light. Prior to the appearance of the granular cells, the entire skin of the fœtus has a glassy transparent appearance, the blood-vessels of the corium being visible through it. Only at the points at which the hairs develop does the granular layer of the inner root-sheath appear before the granular cells of the skin, and in the fœtus of six months they shine as fine white stripes through the uncolored epidermis. Near the end of fœtal life the granular layer makes its appearance at this point also. At birth, aside from the universal hyperæmia, the entire surface is white, except at two points, the borders of the lips and the nail-bed. In both places there is a normal prickle-layer surmounted by a very thick, horny mass; in both the granular layer is absent through the whole of life.

The granules, which characterize this layer, were seen long ago by Kölliker and Auffhammer Langerhans was the first to carefully describe them, without, however, recognizing their constant relation to the process of cornification. I next declared the granular cells to be necessary intermediate forms in the process of cornification on free surfaces, and demonstrated their presence in the excretory ducts of the coil-glands and in the mother-cells of the inner root-sheaths of the hair. At the same time Heynold demonstrated their presence in the vicinity of the nails, and soon afterwards v. Ebner described them very carefully in the mother-cells of the inner root-sheath, without identifying them, however, as I had already failed to do before him, with the granules of the stratum granulosum. Ranvier regarded the granules as drops of a fluid substance, which he believed to exist in a free state also, between the cells of the undermost horny layer, and to which he gave the name "eleidin."

*Keratohyalin.*—We owe our first exact knowledge of this very peculiar substance to Waldeyer. He showed, in opposition to the opinion of Ranvier, that it swells up under the influence of alkalies and undergoes alterations in form under pressure without melting, and could not, therefore, be fluid. The granules are rendered more distinct by the addition of glacial acetic acid and ammonia, because they are less affected by these agents than the substance of the cells. They are insoluble in water, alcohol, ether, and chloroform. The caustic alkalies and the strong mineral acids, and a pepto-glycerin extract dissolve them in the heat. They show a very great affinity for substances which stain nuclei, especially hæmatoxylin and carmin (picro-carmin)—an affinity even stronger than that of the nuclei themselves. They cannot be stained by hyperosmic acid. To judge from these reactions, they cannot be composed of fat or fatty acids; they are distinguished from nuclein by the fact that the latter is soluble in alkalies and carbonate of sodium, even at a low temperature, and from keratin by their solubility in pepsin-hydrochloric acid. No glycogen can be found in them. On the other hand, they correspond almost or absolutely in their chemical behavior to *hyalin*, a product of degenerative processes in various tissues. Waldeyer, therefore, proposes the name *keratohyalin* for the substance of the granules.

The keratohyalin does not first appear in the uppermost rows of cells, those which border on the horny layer, but in the middle strata of the prickle-layer, but only in the

form of isolated granules in the neighborhood of the nuclei. We can speak of real granular cells only when, in ordinary moderate staining, cells appear the entire bodies of which are almost filled with small and large granules. The granules are visible even in unstained preparations, or in those treated with osmium, on account of their strong refracting powers, and are always rendered distinct by the addition of glacial acetic acid; but only when the sections have been stained according to the method described above does the granular layer suddenly appear as a dark-violet or red band, between the prickle and the horny layers. The granules have a rounded form; small ones are often found on top of larger ones. The large ones show lesser powers of resistance to the before-mentioned solvents (Waldeyer). Even when the cells are completely filled with granules, there always remains a slender peripheral zone free from them. This, however, is not sharply defined towards the body of the cell.

Two other kinds of changes also occur in these cells filled with granules. The first is a decided shortening of the peripheral prickles. While these are becoming shorter and at the same time broader, the cells come much closer together, and the interspinal spaces are so much lessened in size that there can no longer be a continuous current of fluid through them. In the interior of the cell the nucleus undergoes atrophic changes, seeming constricted at certain points, or assuming a mulberry or other shape, but always becoming smaller. It is still capable, however, of being well stained. The cavity in the cell-body, which was occupied by the nucleus, retains meanwhile its original size, the contracting nucleus having drawn away from its walls.

The following changes, therefore, take place simultaneously in the prickle-cells as they grow old, and that quite suddenly; the nucleus shrinks, the cell-body becomes filled with granules of different sizes, composed of keratohyalin—a substance peculiar to the process of cornification; the peripheral zone of the cell becomes differentiated, as a clear border, from the remainder of the cell-body, and the intercellular connecting bridges become much shorter and thicker; these changes characterize the granular layer, and the cells are now ready to undergo cornification.

*Horny Layer.*—Immediately above the uppermost granular cells the first horny cells now make their appearance as perfectly clear transparent bodies. All the strongly refracting granules have disappeared from their interior—a change which takes place very quickly. On hæmatoxylin specimens it can be seen that in the undermost horny cells very minute granules with faintly defined broad clear spaces around them are still present, and we must, therefore, believe that the granules disappear by melting into the remainder of the cell-protoplasm. At the same time the last traces of the intercellular juice-canals seem also to have disappeared at this point. It is true that these horny cells do not lie flat upon each other, and I stated in 1875 that they still present very fine teeth (rudimentary prickles) on their surfaces. But it can be very well seen, particularly on portions of the horny layer which have been digested with pepsin and trypsin, that these teeth strike upon each other, and are, therefore, on isolated cells, nothing more than broken rudimentary *connecting bridges, which remain, although reduced to a minimum, during the process of cornification.* From this it follows that the horny cells retain their connection with each other by the persistence of the connecting threads which were present from the beginning.

The method of digestion is a very important one for the study of the horny layer, for it shows that the process of cornification does not affect the whole cell, but only its outermost layer. If the digestion be sufficiently prolonged, the entire contents of the cells are destroyed, and empty shells of horny substance of the shape of a melon or a

gourd, and much elongated, are left behind. The horny layer as a whole has, therefore, the structure of a honeycomb, in which the wax-cells are replaced by horny shells. Very thin (5–10 $\mu$ thick) sections of the horny layer, therefore, show, after being digested, a large-meshed net or horny substance without contents, the strands of which are formed from two horny threads running close together, which are united by very short horny bridges. These horny threads, the cross sections of the horny membranes, are everywhere of the same thickness (about 1 $\mu$), even throughout the entire breadth of the horny layer of the heel. Somewhat thicker cross sections, treated in the same manner, show *incised horny cells* with yellowish horny lateral walls; here, débris of nuclei can also be found, after digestion with pepsin, even in the highest part of the horny layer. It has hitherto been believed that the horny cells of the epidermis have no nuclei. This is, however,

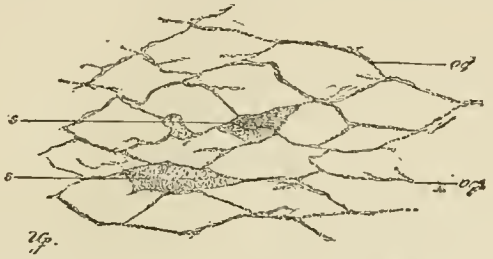

Fig. 6.—Thin vertical section through fresh horny layer from the sole of the foot. Complete digestion by trypsin. *o q*, optical cross-sections of the horny membranes in contact by means of fine prickles; *s*, pieces of the horny membranes seen from the side.

not absolutely correct, as I showed in 1875. The nuclei of the epidermis do not disappear by being dissolved, but by desiccation, shrinking and crumbling, and traces of them can, therefore, still be found in the upper part of the horny layer. On sections half digested in an acid solution, there can be seen in the incised horny cells remains of the cell-body stretched like a veil between the horny membrane and the remains of the nucleus.

The fact that we find *the type of an animal cell-membrane* reproduced in the cornified cells of the epidermis demonstrates the necessity of coloring only *thin sections* if we wish to obtain good, uniform stainings. Thus horny cells entirely or partially cut through are stained red by picro-carmin, whereas whole ones turn yellow.

If double and triple stainings are employed, the most brilliant cell-mosaic may be obtained on sections not quite thin enough, to which no importance should, however, be attached, although such an appearance has puzzled many an observer.

From this fact many important conclusions may be drawn, bearing upon pathological changes in the horny substance. Just as the swelling up of the horny cells in dilute alkaline solutions[1] is really a swelling up of the cell-contents, which passively distends the membrane into a globular shape; enormous distentions, with the formation of medullary cavities, etc., also occur very frequently in the fully developed horny substance. No plausible explanation of this phenomenon has as yet been advanced. Here the alterations in *the contents of the horny cells* take place under the influence of the alkaline tissue-fluid. *The densest horny masses do not consist of solid horny substance, but of a honeycomb-like horny frame-work.*

Ranvier was the first to call attention to the fact that, in treating the epidermis with hyperosmic

[1] This fact also explains the curious phenomenon that the horny cells swell up much more rapidly in dilute than in concentrated alkalies. The horny membranes are but slightly affected by alkalies and acids, but are readily permeable by water. For this reason dilute alkalies gain access to the contents of the cells much more readily than concentrated alkalies.

acid, a lower stratum of the horny layer (three to five cells thick) assumes an intensely deep-black color, like that of the horny cells which were in direct contact with the acid on the surface and sides of the specimen, whereas a middle layer of horny cells remains white, "if the action of the acid were not too intense." This observer explained the peculiar appearance of the black border around osmium specimens by the difficult penetration of the acid from all sides into the horny layer. I showed that this explanation was unsatisfactory, and that one lower zone of horny layer really has a strong elective affinity for osmic acid. Ranvier, in the latest number of his "Traité technique," makes a very noteworthy attempt to explain the different appearances. He says that the human skin normally contains fat, which explains its blackening by osmium, which does not occur if the horny layer is previously deprived of its fat by absolute alcohol; for the same reason the first row of cells above the granular layer, which contain no fat, on account of the presence of water, do not take on the osmium staining. It will be seen from what follows, that the statement of Ranvier that fat plays a part in the staining of the horny cells by osmium, is, in fact, correct, but that the conditions under which this occurs are of a very complicated nature, and that further investigation of this subject may throw much light upon the constitution of the horny layer.

*Table Showing the most Important Color-reactions for the Horny Layer of the Palm of the Hand.*

| Names of the layers of the epidermis. | | Consistence. | Hyperosmic acid. | | Picrocarmin. | Hæmatoxylin (glacial acetic acid). | Iodine-violet (but little decolorized). | Salicylated chloride of iron (after H. Hebra). |
|---|---|---|---|---|---|---|---|---|
| | | | Containing fat. | No fat. | | | | |
| A. Horny layer (Stratum corneum). | 1. Sup'rficial | Dense.. | Black .... | Light .... | Yellow. | Bluish white | Blue .. | Brown. |
| | 2. Middle... | Loose .. | Light..... | D'k brown | Red .... | Violet..... | | Light. |
| | 3. Superbas'l | Dense.. | | | D'k red. | Bluish- | Light... | Light br'wn |
| | 4 *a*. 4. Basal (str. lucidum Oehl) 4 *b*. | Very dense. | Black .. | Light... | Yellow. | white. | Blue .. | not con- |
| | | | Light .... | D'k brown | | Granules. | | stant. |
| B. Granular layer (Stratum granulosum). | | | Protoplasm stained (green). | | | Stained violet. | Nuclei | Brown. |
| C. Prickle layer (Strat. spinosum). | Rete (Malpighi). Germinal layer Flemming. | Soft, near Bdens'r | | | Nuclei stained (dark red). | Nuclei stained (blue). | stained (blue). | Light brown. |

We find that the horny layer presents four different strata, which I shall designate the superficial (or terminal) layer, 2. the middle layer, 3. the superbasal, 4. the basal horny layer. The basal horny layer, to judge from its reaction with osmium, comprises two or more very distinct subdivisions, which are always present. In the preceding table, I have distinguished these as 4 *a* and 4 *b*. The basal horny layer is the hardest, the connection between the cells being somewhat less firm in

the superbasal layer, and much less so in the middle layer. The superficial terminal layer is more firmly constructed and harder than the two latter. It will be at once seen from a study of the next two columns of the table *that the action of osmium upon the horny layer cannot be regarded as identical with its action upon fatty bodies.* If it were, the acid would have no effect whatever after removal of the fat, *i. e.*, all four divisions of the horny layer would retain their light color. Instead of this, the remarkable fact becomes manifest that, in consequence of the preceding thorough removal of the fat (by treatment for weeks with ether constantly renewed), complete inversion of the osmium staining takes place, so that zones 1, 3, and 4 *a*, which otherwise would be turned black remain light, after removal of the fat, whereas, on the other hand, 2 and 4 *b*, which in fresh skin are not affected by the acid, assume an intense brown color after being freed from fat. The action of the acid upon epidermis deprived of its fat is the same, whether this has been accomplished by ether or by absolute alcohol. This fact is very difficult of explanation, and cannot be reconciled with the view that osmic acid only marks out the distribution of the fat in the epidermis. The most singular thing about these reactions is evidently the splitting up of the basal horny layer, Oehl's stratum lucidum, into two subdivisions, the lower of which contains only one row of cells,[1] the upper from three to five, and which, even in the smallest space, shows the above-mentioned inversion. Just as the osmic acid proves that the basal horny layer is composed of two entirely distinct layers, so the results of staining with picro-carmin and iodine-violet render necessary the recognition of a special layer between the hard basal and the middle softer horny layer. This I have called the superbasal layer, and have shown that it passes along the sweat pores nearly to the surface of the horny layer, forming rings around them. Hæmatoxylin has but little effect upon either the basal or the superbasal horny layer (see table). In specimens stained with hæmatoxylin, however, the basal horny layer seems narrowed from below, the row of cells, 4 *b*, being wanting. This appearance is due to the fact that the remains of granules which can still be found in it are stained by the agent, and, therefore, the entire layer seems to be a part of the deeper-seated granular layer. The superficial firmer horny layer, in staining with picro-carmin, hæmatoxylin, and iodine-violet, shows the same colors as the firm basal horny layer, while the softer middle layer is differently stained by each of the first two of these agents. In deep staining with iodine-violet, the whole superficial and middle horny layer is blue; if the specimen be decolorized, a row of horizontal white bands appears here alternating with blue. The broadest of these and the first to appear is our superbasal layer. Those which show themselves later and higher up, show that the same process which passes from the basal to the superbasal horny layer begins still more frequently within the horny layer, and, therefore, that the whole range of variations in color is due to entirely mechanical causes. It is, in fact, a physical necessity that, beginning with the basal horny layer, which covers the whole surface of the body like a dense horny cloak, changes should take place externally in the other horny layers. For while new horny cells are added from within to the basal layer, the outer ones are spread over a larger area, and stretched and loosened by the surface tension. The horny membranes must necessarily become thinned, and the intercellular spaces widened, in order that the fat may more readily penetrate into the skin. Whether these mechanical relations alone suffice to explain the inversion of the osmium-staining, I must leave undetermined. But as the horny cells possess only a limited degree of elasticity, this tension cannot continue indefinitely; when they can no longer yield to it, they must again constitute a denser layer, a few rows of cells higher up, and compress those which follow them. For this reason, light and colored bands alternate in sections stained with iodine-violet, and the same process ultimately leads to the formation of the dense superficial terminal layer, in which aid is furnished by the factor of atmospheric desiccation. If this terminal layer be further stretched, it ruptures, and the cells are cast off in horizontal scales.

[1] This layer, 4 *b*, was formerly described by me, after the usual osmium reaction, as the "clear" layer (1875), but I at the same time stated that the stratum lucidum of Oehl comprised the two layers 4 *a* and 4 *b* (see table). In spite of this fact, Ranvier his recently (probably by an oversight) identified this (my former "clear" layer) with Oehl's stratum lucidum. The stratum lucidum is that layer containing from four to six rows of cells, which on fresh unstained sections attracts the attention by its transparency above the prickle and granular layers. As my former "clear" layer can be found only after the uninverted osmium staining, and as such special names should be avoided, I now abandon it entirely. Oehl's stratum lucidum should also be dropped as an inexact term, and also because it does not require a special name, it being only a portion of the horny layer.

*The thickness of the entire horny layer, aside from that of the underlying prickle-layer, is therefore dependent upon only two factors:* 1. The quantity of the bridge-like connecting threads, and 2. their density and elasticity after their conversion into horny substance.

If we take a connected view of these histological facts, we are already in a position to form a morphological, even if not a chemico-physiological notion of the nature of the process of cornification. Ever since the appearance of the work of Langerhans on the granular layer, there has been a great deal of fascination in the view that a factor had been found in the granules of this layer which controls the process of cornification, since we could either regard them as already formed drops of horny substance, or at least as an intermediate product between albumin and keratin.

*Signification of Keratohyalin for the Process of Cornification.*—The former view was adopted by Zabludowski for the cornification of the bills of birds, while Waldeyer, who found keratohyalin also in the medulla of the hair, the hoof of the horse, and the claws of ruminants, thinks it very probable that a close connection exists between this substance and the process of cornification. For the internal root-sheath, he imagines "that the keratohyalin once formed gradually becomes reunited with the protoplasmic network within which it originated or was deposited, and that the horny substance is the result of this union." This renewed solution of the keratohyalin in the protoplasm of the cells seems very probable, to judge from the microscopic appearances. *The true cornification of the cells of the epidermis, however, affects only the outer layer of the cell, and consists in the formation of a horny membrane.* We have already seen that the contents of the horny cells are just as readily digested by pepsin (and trypsin) as keratohyalin before it has been redissolved in the former. We cannot, therefore, say that either the former or the latter is *cornified. Cornification is a process which takes place in the epidermis, and is entirely confined to the periphery of the cells and their protoplasmic connecting threads.* The changes which take place in the interior of the cells, particularly the appearance of keratohyalin, are secondary phenomena which have a bearing upon cell life in general, but not upon cornification.

The statement thus made about the epidermis is in perfect harmony with our experience concerning keratohyalin in other respects. It is supported by the capriciousness exhibited by this substance in the various places in which it is found. We sometimes find it in large quantities, but occupying a limited space just below the point of complete cornification (epidermis), and sometimes, long before this process begins, in higher layers (internal root-sheath); in many places (variola, vaccine process), in which a high degree of cornification is reached, it is entirely wanting, or almost entirely, and, on the other hand, we find it in large masses in places where cornification is very incomplete. We must, however, also recognize the fact that this substance should not be regarded simply as the result of a senile change in the cells of the epidermis, for it does not appear in the external root-sheath which so long remains unproductive. *Therefore the appearance of keratohyalin, although an accessory phenomenon of the process of cornification, is really produced by the latter, which affects the periphery of the cell, not vice versa, the appearance of keratohyalin leads to cornification.* Peripheral cornification of cells without the appearance of keratohyalin frequently takes place, as was just intimated. These statements refer, in the first place, only to cornification of the cells of the epidermis, and it is possible that subsequent examinations of other kinds of epithelium during the process of cornification may demonstrate the presence of horny material in the interior of the cells, perhaps as a horny frame-work.

*Development of the Nail.*—Embryos of two or three months seem at the first glance to be already provided with nails. A more careful examination shows, however, that no true nail exists; the posterior and lateral folds and the free border are wanting; the impression of a nail plate is due to the circumstance that the surface of the last phalanges of the fingers and toes is smoother and more shining than the rest of the skin, and, without forming a distinct wall, is more firmly united to the underlying tissues. At this time (see Fig. 7, 1), the epidermis of the toe consists of several layers of epithelium; the undermost, beautiful cylindrical cells; above them two or three rows of prickle-cells, and over all a few layers of horny cells, without intervening granular cells. Only on the dorsal surface of the ungual phalanx is there an altered epithelium upon a surface bounded anteriorly by a groove (*r*) running across the tip of the finger, and posteriorly by a depression in the epithelium which runs obliquely inwards and backwards. This entire portion of the skin is closely united with the cartilaginous end phalanx by means of a firm and relatively mature connective tissue. It is covered by a cubical epithelium, a thin prickle layer, and a thick lamellated horny layer. The last passes from the dorsum of the second phalanx over the oblique epithelial ridge and the entire end phalanx, and gives to the skin of the latter its horny character. It extends beyond the anterior groove, and becomes inserted into the tip of the finger.

In the study of comparative anatomy, we meet with several instances of such partial cornification. One was described by Welcker in the sloth, under the name of "epitrichium," as a membrane covering the hairy coat of the animal like a second amnion, which is afterwards cast off. It was more correctly described by Kölliker as the horny layer of a former fœtal period. Welcker had in mind the fact that the epitrichium is transformed into the nail of the sloth. In the case of the fœtus of the hog, I can vouch for the conversion of the epitrichium, which is also present there, into the embryonic hoof, and hence I believe that in the human fœtus also the above-described horny layer of the ungual phalanx would pass into an epitrichium covering the whole skin if the horny layer in general had a firmer consistency. In the human subject, however, a trace of the horny layer of the first fœtal months remains only on the ungual phalanx till a later period, and to this, in imitation of Welcker's term, I have given the name "*eponychium*," and also for the reason that the subsequent nail really comes out from under this peculiar horny covering. During the whole of life, we find a small horny plate at the posterior nail-fold, which passes down from the back of the finger upon the nail, and, if it becomes adherent to the latter, gives rise to lacerations of the horny layer of the back of the finger. For this reason, we are in the habit of keeping it carefully separated from the nail. This plate is the indistinct residue of the fœtal eponychium.

Fig. 7, II. represents the toe of a fœtus of four and a half months. The distal phalanx has much increased in size on the flexor aspect where the skin is loosely attached to the phalanx; at this point the so-called "pulp" of the (fingers and) toes is formed. We find the first papillæ and epithelial processes, but only in places where the connective tissue is loose, *i. e.*, back of the posterior epithelial ridge and below and in front of the anterior groove. No epithelial process is developed on the dorsum of the phalanx. In this way *three entirely different regions are marked out on the distal phalanx of the toe*, which steadily become more distinct; that behind the epithelial ridge, as the nail-wall, the sterile middle portion as the subsequent nail-bed, and that before the groove as the pulp of the toe; the posterior epithelial ridge is at once recognizable as the subsequent nail-fold. It is easy to see that it is the firm eponychium which, passing from the nail-wall to the pulp of the toe, hinders the free development of all the tissues underneath it. Under this firm horny covering there arises at about this time *the first trace of the definitive nail*, in the shape of a small lenticular collection of large transparent prickle cells at the orifice of the nail-fold (see Fig. 7, II., *n*).

In Fig. 7, III., which illustrates a longitudinal section of a toe of six months, the definitive nail ($n$) has already attained larger dimensions, the large transparent cells having penetrated further backwards into the nail-fold, and pushed themselves forward under the eponychium, becoming meanwhile cornified from before backwards, as can be recognized from their assuming a yellow tint when stained with picro-carmin. Granular cells do not appear during this process, for which reason no white transitional zone can be recognized macroscopically. The nail-fold, like the nail-bed, still retains its cubical

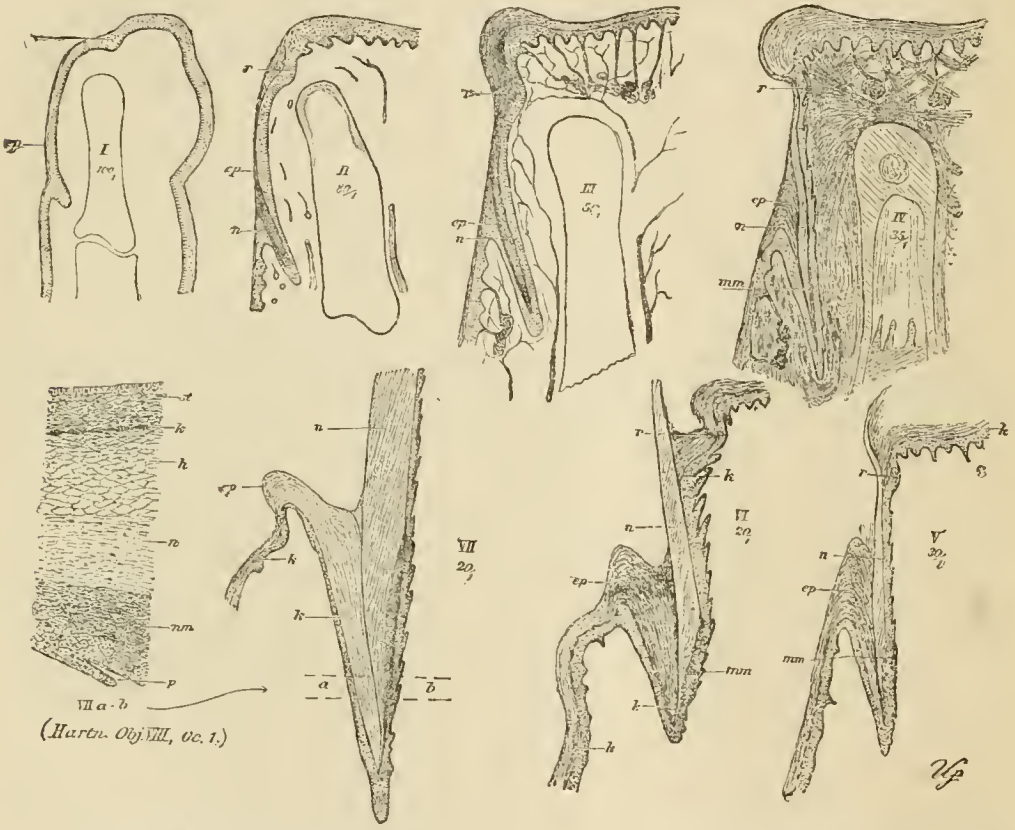


FIG. 7.—Development of the toe-nail.—I. 3d month, *e p*, eponychium; *r*, upper groove; II. 4½ months; *n*, rudiment of nail. III. 6 months; IV. 8 months; *n*, *m*, matrix of nail. V. at birth; *k*, granular layer. VI. child 3 weeks old. VII. child 3 years old. VIII. *a b*, section *a b*, from VII. magnified; *s t*, prickle-layer of roof of nail-fold; *k*, granular layer of roof of nail-fold; *h*, horny-layer of roof of nail-fold; *n*, nail; *n m*, matrix of nail; *p*, papilla of matrix of nail.

epithelium, the outer rows of which are everywhere arranged perpendicularly to the surface of the corium. The mature nail-cells push themselves in between the prickle and horny layers of the nail-bed, and slowly progress forwards. The nail-wall and the pulp of the toe have at this time already sent out numerous epithelial cones and coil-glands into the loose connective tissue, and the slowness of the development of the region of the nail becomes more and more striking. The nail-fold, although it has nearly doubled in size, no longer reaches posteriorly as far as the condyles of the phalanx, nor does the upper epithelial groove reach the pulp of the finger anteriorly, but is pushed by the steady growth of the phalanx back upon its dorsum, being still held in close con-

tact with the nail-wall by the eponychium. At this time the further shaping of the connective-tissue surroundings of the nail has made progress. The two lateral digital arteries give off two transverse anastomosing vascular loops, corresponding exactly to the epithelial ridge and the anterior groove. The nail-bed is supplied by these with very fine arterial capillaries, which empty into broad venous ones. The bundles of fibrillæ which constitute the nail-bed originate from the periosteum of the under side of the end phalanx (see Fig. 7, IV.), and spread out over the head of the phalanx in the form of a broad fan, towards the pulp of the toe and upwards and backwards towards the whole nail-bed. On the tip of the toe these fibres are crossed obliquely by others, which come from the anterior part of the nail-region, and thus very wide meshes are formed at this point, in which coil-glands and lobules of fat are inclosed. At the posterior part of the nail-bed, the last fibres of the fan bend over towards the periosteum of the upper side of the phalanx, in consequence of which the connective tissue near the nail-border becomes less dense. The nail-fold is surrounded by bundles of fibres which are cut across in making longitudinal sections, and are seen around the horse-shoe-shaped nail-fold, running at right angles to the axis of the toe. This arrangement of the fibrous bundles of the corium enables us to comprehend: in the first place, that the anterior portion of the nail-bed is closely united with the anterior flattened part of the phalanx, while the posterior portion, and still more the nail-fold, have a softer and more yielding foundation, and that the epithelial cones which are afterwards sent out (see Fig. 7, V., VI., VII.), all follow the course of the connective tissue, with their apices directed forwards.

In Fig. 7, IV., which shows the toe-nail of a fœtus of eight months, the eponychium in its entire anterior portion has yielded to the efforts at growth of the parts around it. It still remains only upon the posterior part of the true nail, in the form of a broad "anterior horny plate." We see that the front part of the tip of the finger, freed from its pressure, has produced a thick mass of horny layer. The nail, which has already crept thus far forwards under the eponychium, in the form of a very thin plate, passes upon this mass as a delicate horny lamella, and we now obtain macroscopically the peculiar appearance of a free nail, no longer covered by the eponychium, which still has no free edge, however, but terminates in front upon a transverse horny mass.

Fig. 6, V., shows us the toe-nail of a new-born child. Microscopical examination shows that the granular layer has appeared between the prickle and the horny layers, everywhere except at the border of the nail. It passes from the back of the finger around the nail-wall into the hindmost corner of the nail-fold, where it terminates. In the same way it passes from in front under the nail as far as this is unattached to the skin, and here also it suddenly disappears. Epithelial proliferation also takes place at this time upon the nail-bed freed from pressure, by which numerous cones are sent out in the direction of the pulp of the toe. On macroscopical examination a characteristic change is seen. The anterior transverse horny mass already described becomes torn through in the middle layers, and scales off until the normal level is reached. In consequence of this the nail, which has crept forwards over it, now stands exposed in the form of that irregular edge, thin as paper which usually falls a victim to soap and water during the first few days after birth.

Fig. 7, VI., represents the toe-nail of a child three weeks old. The epithelial cones of the nail-bed have grown still larger. At the bottom of the nail three or four papillæ, which were faintly marked near the end of fœtal life, have become greatly developed. Their growth is intimately associated with the increased production of nail-substance which now goes on over the whole bottom of the nail-fold. The fully-formed nail has,

in comparison with that of a new-born child, increased considerably in thickness, but is still much thinner at its free edge than at the orifice of the nail-fold. The roof of the nail-fold has been somewhat elevated by the growing nail, so that its orifice is widened. The remains of the eponychium are still visible in the form of the thickened anterior lip of the roof of the nail-fold. The nail still passes smoothly over the prickle-layer of the nail-bed, without receiving additions from it. That portion of it which is covered by the nail produces neither granular nor horny layer. Just as we shall see later, in studying the hair, it begins to form both layers at the point at which it becomes separated from the nail below. The former upper groove of fœtal life can still be recognized at this point (*r*).

The toe of a child of three years (Fig. 7, VII.) bears a close resemblance to the conditions found in the adult. The nail is now of the same thickness over the whole nail-bed (not represented here) which it has gradually acquired in the nail-fold. We now find the matrix over the whole bottom of the nail-fold; its anterior edge projects a little from under it, and can at once be recognized during life as a white crescent. The matrix and the nail-bed both show papillæ and epithelial cones, lying in the same plane and directed obliquely forwards.

The development of the nail on the toe is virtually the same as on the finger, except that the eponychium desquamates much earlier on the latter than on the former, so that the finger-nail is set free sooner than the toe-nail; finally, the finger-nail remains thin longer than the toe-nail.

*Nail of the Adult. Individual Nails and Hairs.*—The nail of the adult is a horny plate, curved from right to left, which begins with a narrowed extremity at the bottom of nail-fold, in passing through which it attains its definitive thickness, which, with rare exceptions, it retains over the entire nail-bed. If left uncut, it grows far beyond the latter, and terminates a certain distance beyond the tip of the finger narrowed and bent downwards. When left to itself, therefore, it has a natural "typical length" dependent in part upon its original thickness, in part upon the cohesion of its cells. A continuous addition to it, a tergo, would cause it to far exceed its natural length, if this were not preserved by the natural desquamation. The attainment of the "typical" length does not indicate, therefore, in uncut nails, an arrest of growth, but the establishment of a balance between new formation and loss of tissue. As in the normal condition the nail grows during the whole of life without pauses of absolute arrest, there can be, of course, only one individual nail for each matrix, from its fœtal origin to death. A succession of single individual nails upon one matrix is always pathological. The hairs, however, fall out as a rule, after having preserved for a considerable period the condition of balance of the "typical" length, and make place for new individual hairs. A succession of single hairs in one and the same follicle is normal. This difference is based upon the much more simple conditions of growth of the nail.

*The True Nail, or the Nail Plate.*—A more exact definition of the meaning of the word "nail" is essential from a pathological standpoint. I propose that we apply the term "nail" only to that which projects beyond the top of the finger (in analogy with the hair-shaft), in fact, only the plate of the nail. We define this true nail (nail-plate) *as the horny mass which takes its origin from the entire floor of the nail-fold, as far forwards as the edge of the lunula, and, bent over forward in the form of a thin curved plate, is pushed onward, fitting closely upon the ridges of the nail-bed, without receiving contributions from it.*

In view of the great superficial extent of the nail-plate, it is very desirable that we

thoroughly understand its interior. If we for a moment picture it to ourselves, not as bent over anteriorly by the roof of the nail-fold, but as growing straight up in the air like a hair, we find that vertical *horny threads* pass out from all points of the matrix, *i. e.*, from the whole floor of the nail-fold; but in view of the general cohesion of the nail-cells one can just as well say that *layers of horny matter* which are heaped up parallel to each other are secreted by the matrix. If we now in imagination consider the bending over forwards of the whole mass, we see that the horny threads which pass over the surface of the nail come from the most posterior part of the nail-fold, those which run through its middle from the middle, and the undermost from the anterior portion of its floor, which terminates with the lunula. *Changes in the upper surface of the nail* must, therefore, be referred to *the bottom of the nail-fold, those of the under surface to the region of the lunula.* It is also evident that if we seek

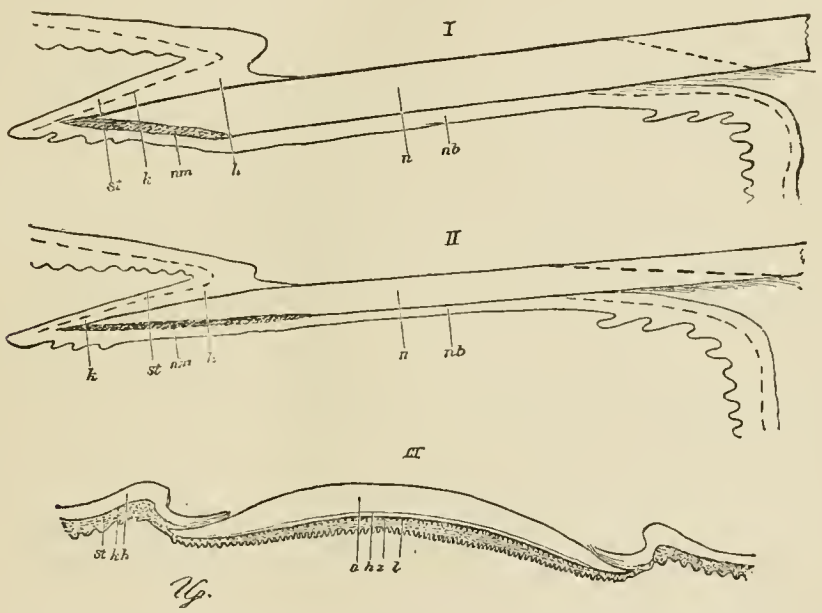


FIG. 8.—Schematic sections of nails. I. Longitudinal section through a thick, II., through a thin nail. The former has a broad nail-fold, the latter a narrow one; *n b*, nail-bed; *s t*, *k*, *h*, *n*, *n m* as in Fig. 7. III. Transverse section of a nail; *l*, ridges of the nail-bed; *z*, dentate processes of the nail; *h*, clear lower part of the nail (erroneously called the horny-layer of the nail-bed); *n*, nail; *s t*, *k*, *h*, prickle, granular, horny-layer of the epithelium at the sides of the nail-fold (perionyx of Arloing.)

inside the nail for the cells which were produced at one and the same time by the matrix, we shall find them in a plane parallel to the latter running obliquely from behind and above forwards and downwards, and not, as is usually believed, in an artificial vertical cross-section of the nail. Such a plane as this which shows the natural layers of the nail I call the "plane of stratification."

*Plane of Stratification of the Nail. Growth of the Nail.*—It requires only a little reflection to understand that the same mass of horny matter will be pushed over more evenly by a narrower nail-fold, that the plane of stratification will be more horizontal, the nail thinner, and the rapidity of its onward progress increased in the same ratio. A nail-fold with a broader opening than usual will also correspond to a more abruptly descending plane of stratification, and to a thicker and more slowly moving nail. The two schematic longitudinal sections (Fig. 8, I. and II.) through a

thick and a thin nail will elucidate these conditions. The forward movement of the nail upon the ridges of the nail-bed is, therefore, not to be identified with *the growth of the nail*, it being only one factor of it. Correct notions concerning the relative growth of a nail at different periods, or of several nails at one and the same time, cannot be formed except by either weighing the parings (Moleschott) or by comparing the products of the thickness of the nail at a particular time with its forward progress at that time.

A more careful consideration of the changes which may take place in a nail-plate during its movement forwards teaches us that a constant *increased growth at the posterior part of the nail-fold* is followed by a gradual increase in the steepness of the plane of stratification on the bed of the nail, in other words, *a steady thickening of the nail;* while an increased growth at the anterior edge of the lunula induces a gradual thinning of the nail subsequently. If we examine normal nails in the light of these facts, we find the widely varying statements which have hitherto been made fully corroborated, the nail-plate, estimated from the anterior edge of the lunula, retaining, as a rule, the same thickness, until after it has gone beyond the end of the finger, in some cases even becoming thicker, although, as can be proven on well-stained sections, no addition is ever made to the nail by the nail-bed. This increase in thickness is therefore due to a more active growth at the bottom of the nail-fold, which is characterized, as we know, by the presence of from three to six rows of papillæ, even in the fœtus. These papillæ, which are arranged in horse-shoe-shaped rows, with their concavities turned forwards, and run parallel to the edge of the nail-fold, present individually greatly varying degrees of development. I have several times found them very slightly developed in the adult.

*Papillary Layer of the Substratum of the Nail.*—In the majority of instances, however, the configuration of the papillary layer over the whole substratum of the nail is exactly as it has recently been described by H. Hebra. Beginning from behind, we first find the horse-shoe-shaped semicircle, composed of several (three to six) rows of very slender papillæ. Next to this section comes a lenticular space, inclosed behind and before by slightly curved lines, the anterior border of which corresponds exactly to the anterior edge of the lunula. This space contains comb-like ridges bearing papillæ which steadily decrease in size anteriorly, and entirely disappear near the lunula. These ridges do not all run parallel from behind forwards, but converge symmetrically in their posterior division to a point lying behind the nail-fold, those situated externally adapting themselves to the curved border of the nail-fold. *These two divisions together correspond to the matrix,* so that the latter in itself is by no means homogeneous, having posteriorly a papillary, anteriorly a simple bed-like character. Further forwards the *nail-bed* follows as a third section, which begins at once with from sixty to ninety high ridges, which pass as far as the pulp of the finger, retaining the same height, and there become lost in rows of papillæ. The ridges of the nail-bed carry the longitudinal branches which arise from the posterior and anterior vascular loops on the floor of the nail.

*Blood-vessels of the Nail-bed and Matrix.*—With the decided increase in the size of the nail-bed after birth, the vascular system of the pulp of the finger, which originally had no connection with its dorsum, exerts a constantly increasing influence upon the circulation of the nail-bed. The vessels of the ridges give off to their surfaces at regular intervals capillary loops which seem as if compressed from above, and hence present peculiar appearances.

This complicated vascular arrangement is rendered still more puzzling by the fact that the larger arteries and veins, from which the capillaries of the matrix and nail-bed arise, present certain peculiarities which are found only in the erectile tissue of the corpora

cavernosa. Hoyer has shown that well-marked branches of the digital arteries empty directly into the very broad, thin-walled lacuna-like veins of the nail-bed, in addition to the venous capillaries of the ridges. It is evident that general venous stases may, in the absence of a capillary system, extend their influence to the arterial system, and thus localize it, and on the other hand, that each increase in arterial tension here finds a safety-valve, which is capable of nullifying the effect of a moderate increase upon the nail-bed, the finger, and the whole of the extremities.

*Nail-fold.*—The greater part of the surface of the nail is free, but it is covered behind and at both sides. A broad posterior and two narrow lateral portions can be distinguished on the surface of the horse-shoe-shaped nail-fold. The whole covering is, however, of a uniform structure, as regards its connective-tissue substratum and the epidermis over it. It is composed of a loose connective tissue, containing coil-glands and fat, the vessels of which communicate both with those of the surrounding corium and those underneath the nail. The epidermis has three complete layers, the prickle, the granular, and the horny, which everywhere uniformly extend to the substratum of the nail. The more the lateral portions of the fold retreat from the nail the more it frees itself from them anteriorly, the greater is the quantity of horny layer produced by the substratum of the nail under these lateral edges, so that on the anterior portion of the nail-bed the edges of the nail no longer slide forwards over the bare prickle layer, but over a foundation of horny layer.

This condition may be studied upon successive cross-sections of the nail. Just as, at the posterior part of the nail-fold, a small horny plate which entirely disappears anteriorly, extends in many persons from the horny layer of lateral covering of the fold upon the nail. This crescentic horny layer is the now insignificant residue of the fœtal eponychum (perionyx).

Anteriorly the corium goes at once from the upper surface of the nail to its under surface to form the pulp of the finger. Here also the skin has all three of the layers of the epidermis, which successively attach themselves to the nail from below, at first the horny, then the granular, and last the prickle layer. The last alone continues under the nail, as the epithelium of the nail-bed, entirely without change as far as the lunula. The small space, in which the three layers of the epidermis come successively in contact with the nail from below, can be very easily recognized with the naked eye upon the surface of the nail, as a yellowish-white stripe convex anteriorly, somewhat narrower in the middle than at the sides, to which but little attention has hitherto been paid. On a careful examination it can always be distinguished from the waxy, transparent (or, in consequence of the penetration of air into it, milky-white) free edge of the nail on the one hand, and the red nail-bed on the other. The epithelium of the nail bed consists entirely of prickle cells, which not only fill out the grooves between the ridges, but are also spread over the surfaces of the latter. Seated directly upon the ridges, elongated cylindrical cells are everywhere found, and above them others of a flat or triangular shape. The nail passes closely over this prickle layer, firmly attached to it by ridge-like projections from its under surface, which correspond to the grooves of the nail-bed, on a cross-section appearing as teeth (see Fig. 8, III.) and on the under surface of the forcibly removed nail as fine longitudinal ridges. The lowermost layer of the nail, which consists of cells of lesser density than those of the upper layers, appears in a transverse section as a band somewhat paler in color than the rest of the nail (see Fig. 8, III.). It has therefore frequently been regarded as something peculiar to the nail-bed, as its horny layer. Such a layer, however, is found on the nail bed only under pathological conditions.

In the region from the lunula to the posterior edge of the nail-bed the nuclei of the prickle-layer again become very deeply stained when exposed to coloring agents; there are more layers of cells, particularly towards the anterior edge of the lunula, and it passes above into a brownish layer of cells, a variety intermediate between the prickle-cells and the nail-cells proper.

I described this transition in 1875 as follows: "The prickles of the clear mother-cells of the nail become more and more distinct, while the cells become flatter; in this way a strongly punctate, darker, transitional layer is formed. From this the very flat and shining nail-cells, covered with delicate teeth, are finally developed. There is here no trace of a granular layer." Waldeyer, however, believed that he could recognize between the mother-cells of the nails and the nail-cells proper, two rows of cells which contain keratohyalin in very fine globules. Ranvier claims to have found not keratohyalin, but granules of a peculiar kind in the transitional cells, which are stained brown (not red) by picro-carmin, and are solid (as keratohyalin also is, according to our view). Ranvier calls this the "substance onychogène." After again investigating the matter, I must still maintain that the points which cause the brownish appearance lie upon the surfaces of the cells and *not in their interiors*, and are nothing more than the much more distinctly outlined prickles. It can be seen on horizontal sections of the zone of transition that the interior of the cells is free from granules. In the subsequent cornification of the peripheral layer of the cells, the prickles become shorter and more indistinct, but even later they give a peculiar glittering appearance to the nail-cells on thin sections.

*Color of the lunula. The yellow band.*—The question now arises whether these histological facts suffice to finally furnish a satisfactory explanation of the border of the lunula upon the nail, which has hitherto never been entirely understood. The answer must be in the affirmative. In the first place, that which we call the lunulâ, viz., the little white crescent which appears in front of the nail-fold, does not really end at the edge of the covering of the nail-fold, but extends on either side to the lateral edges of the nail. Frequently, perhaps always on the toes, the lunula becomes visible only after the roof of the nail-fold has been removed. It has therefore exactly the same relation to the covering of the nail-fold, as regards its extent, as the matrix, *i. e.*, the two parts separated by H. Hebra (the horse-shoe-shaped and the lenticular). *The lunula is the macroscopic expression of the matrix of the nail.* The difference in color of the lunula and the nail-bed is not one of degree, due to the fact that the latter contains more blood than the former (Henle), but an absolute one. Blood never gives a color to the lunula under any circumstances, whereas the color of blood can be readily removed from the nail-bed by pressure. The difference is undoubtedly due to the fact that the nail-bed is covered by a transparent horny substance, whereas there are a number of absolutely opaque elements in the matrix of the nail which completely scatter the light. These are, as we have just seen, the transitional cells, which are covered over and over with points, which by transmitted light appear darker, and by reflected light whiter than the granular cells. Their presence, in fact, marks the exact boundary of the lunula. As regards these physical points I believe that I may rejoice in the approval of Ranvier, when he ascribes the white color of the lunula to the "irregularity of the keratogenous cells." Additional confirmation of the correctness of this view is furnished by the superficial yellow band which I described as situated just before the free edge of the nail. At this point the red color of the nail-bed suddenly ceases, owing to the presence of the opaque granular cells.

*Development of the hairs.*—The first rudiments of the hairs appear on the face in

the tenth or twelfth week of fœtal life ; they appear last on the backs of the hands and feet in the seventh month. The hairs themselves appear about a month later in all parts of the body, and in the same order, beginning with the face. The hair rudiments consist of short conical epithelial sprouts (Kölliker), over which the horny layer passes smoothly, and which are at first separated from the connective tissue only by a thin line. Little by little a dense collection of round and spindle-shaped cells is formed at the fundus of each cone, at first surrounding it like a basket, but soon indenting its base by a projecting mass of round cells closely crowded together, during which process the mass itself assumes the shape of a button with a concave surface. The reactive growth of connective tissue which produces the hair-follicle, therefore, begins at the fundus of the hair rudiment, in the midst of the connective tissue. It is not an indentation of the papillary layer, which is not yet fully developed, but grows around the hair rudiment at the same rate at which the latter descends into the corium during its enlargement. Meanwhile the first changes are also taking place in the hair rudiment. Its outer cells assume the cylindrical shape, arrange themselves transversely to its axis, and appear as a continuation of the basal prickle-cells of the epidermis. The cells which lie in the long axis of the hair rudiment, on the other hand, arrange themselves vertically and become elongated, and at the time when the papilla indents the cone from below, they already appear as a delicate conical structure seated upon the apex of the papilla. Such is the origin of the *primitive hair-cone.*

*Primitive hair-cone.*—Its size is variable, according as the papilla indents the epithelial cone early or later. If the process exists for a certain time without being indented, the primitive hair-cone from the first fills almost its entire length ; if the papilla makes its appearance early, while the process is still small (as is the rule in the hair-change of the adult) there first appears on the papilla a small but broad hair-cone which becomes gradually longer and narrower in an upward direction. In all cases the cornification of this hair-cone begins by the clearing up of the cells at its apex, and spreads very rapidly downwards on the external surface of the cone about as far as the level of the apex of the papilla. The lower end of the hair-cone surrounds the papilla like a cap, and to the same extent as its upper end reaches the surface of the skin. In the almost vertical hairs of the face, the horny layer is usually pushed out in the form of a small lump by the pressure of the hair-cone until it breaks and allows the latter to escape. In the more oblique hairs of the trunk and extremities the hair-cones often grow for long distances in spiral windings in the external prickle-layer underneath the horny layer before making their appearance on the surface of the skin after breaking through the horny layer. Meanwhile a superficial cornification with the formation of granular cells appears around them in the middle of the prickle-layer, similar to that which takes place around the sweat-pores. The hair-cone becomes the mature hair only after it has broken through the horny layer, its central portion growing with increased rapidity, breaking through its hitherto protecting horny covering, and growing on as a fully developed hair, which, however, consists only of cortical substance. The ruptured horny covering remains behind as the inner root-sheath, and crumbles gradually off below the level of the skin, as far as the orifices of the sebaceous glands. The peripheral remains of the original epithelial cone which has been traversed by the hair-cone becomes the external root-sheath, which is, in the mature hair also, only a continuation of the outer prickle-layer, and reaches nearly to the papilla, where it terminates in a pointed extremity. The hair-follicle can now be recognized around the entire hair. Of the

three layers the homogeneous internal lamella is the most distinctly developed, then the middle, transverse fibrous layer, and finally the external longitudinal fibrous layer.

*Differences between the Oblique and the Straight Hair-follicles.*—The position of the hairs is exactly vertical in the eyelashes, vibrissæ, and those on the lips and the nose, and more or less inclined towards the surface of the skin in all those of the trunk, including the eyebrows, and in those of the extremities. The obliquity of the latter increases steadily with the increase in length of the hair-follicles, because they have far too little room in the corium, in a vertical direction, and the more obliquely they lie, the more unequal therefore the tension of the corium on both sides of the hair, the more distinctly does there appear on them a delicate muscular bundle destined to act as a kind of restraining apparatus. This is the rudiment of the arrector pili, which bridges over the constantly increasing obtuse angle between the hair and the surface of the skin. On the vertical follicles no trace of an arrector can be found. An intermediate position between these varieties of hairs is occupied by the secondary hair-follicles of the parts provided with oblique hairs. While I call the very first rudiments which successively appear on the body between the fourth and the sixth month primary, I group together under the term secondary hair rudiments all those which afterwards make their appearance between the former. In parts with oblique hairs, the secondary hair-rudiments penetrate much more vertically into the already thickened corium than the primary, and gradually assume a more oblique position during their subsequent growth only. A corresponding regional difference is also found in the form of the external root-sheath.

*Spindle and Button shaped Swelling of the External Root-sheath.*—Even before the appearance of the hair-cone, two globular swellings of the external root-sheath are visible on all the hair-rudiments, the upper one enabling us, by the fatty degeneration of the cells in its centre, to recognize its future destination as a sebaceous gland. The lower swelling gradually assumes, on the oblique hairs, a very definite form and direction. It projects as a button-shaped, lateral mass in the vicinity of the insertion of the arrector, and always towards the side on which the obtuse angle of the hair is situated. On the vertical hairs of the face, and on the less oblique secondary hairs of the other regions, there is found a circular, more or less uniform swelling and protrusion of the external root-sheath. Both the circular and the unilateral button-shaped swellings are of course the expression of an increased proliferation at this point, and the button-like shape of the latter is due entirely to the fact that the tension of the arrector overcomes the resistance of the sheath of the hair-follicle. *The Three Regions of the Hair-folliele.*—In this way, three regions, lying one above the other, are marked out even on the embryonic hair-follicle; they are: 1st, the funnel of the follicle as far down as the openings of the sebaceous glands; 2d, the region occupied by the swelling; and 3d, the region of the papilla. All three have distinct functions. The middle follicular region (that of the swelling) is already characterized in the embryo by the two following peculiarities: the hair-follicle is thinner at this point, and the prickle-cells can be more evenly and deeply stained than in the papillary region. There is also another point of difference between the regions of the vertical and the oblique follicles. In the oblique hairs, the secondary hair-rudiments in their neighborhood grow towards the point of least resistance, *i. e.*, the region of the button-shaped swellings on the primary hairs, often following a crooked course, going around the sebaceous glands which lie in their way. But otherwise they keep as close as possible to the obtuse angle of the primary hair. The matter is different in regions with vertical follicles. Here, as the surface of the skin increases in extent, a secondary hair rudiment appears and grows vertically downwards, midway between two primary hairs. This can be very well seen on the vibrissæ and the hairs of the external nose of the embryo of six months. Here we find, between two primary rudiments, a secondary one, of course somewhat smaller, and between these three, equidistant from them all, two new ones appear, of still more recent origin, and still smaller.

I come at last to the difference as regards the embryonic hair change between the parts with straight and those with oblique follicles, which is extremely characteristic. The hairs on the lips are the first to prepare themselves for the change in the embryo. In the beginning of the seventh month, all stages of loosening and new-formed hairs are here met with. The process is, in short, as follows: The old hairs are pushed off from the papillæ, their ends assuming a bulbous shape. They ascend in the follicle as far as the swollen middle follicular region, here usually circularly spindle-shaped, where their upward progress is arrested, and continue to grow by accretions received from the epithelium of this region. The lower portion of the follicle does not at once col-

lapse behind them, but becomes possessed of a more transparent epithelium which remains a long time. In good stainings with picro-carmin, it becomes sharply differentiated from the deeply colored cells of the middle follicular region which receive the loosened hair. The lower portion of the follicle becomes gradually shorter, its epithelium disappears, and the ascending papilla atrophies. In the eighth month, these old epithelial processes have disappeared and are replaced by new ones, capable of being deeply stained, proceeding from the old hairs, which are still seated in the middle follicular region. These grow downwards, making the old lower follicular region once more permeable and indented by a new papilla. At the same time, the hairs are thrown off from many secondary hair rudiments.

At this time (eighth month), the loosening of the primary hairs takes place on the scalp and eyebrows, still later on the back, abdomen, scrotum, and in the axillæ. Here also the old lower follicular region at first retains its entire length, becoming shortened after the loss of its contents. Here, however, *the ascending hair alters its direction.* While the middle follicular region is swollen towards the obtuse angle of the hair (in the form of the button-shaped mass), the old hair also turns towards that side when it has reached this point. The effect of this, aided by the action of the arrector, is to produce a deviation of the two upper thirds of the follicle from the direction of the lower third. The consequence is that the old hairs, which are seated in the middle third, without papillæ, arise almost perpendicularly from the follicle, and a further consequence is that the young epithelial processes, which the old hairs send downwards from this point near the end of fœtal life, are diverted from this vertical direction into that of the old oblique lower portion of the follicle. Thus is produced the curious appearance of *lateral processes* projecting from the lower ends of all the hairs of this period.

*Hair-Change at the Time of Birth.*—In the same order as that in which the primary follicles originally appeared, proceeding from the face towards the hands and feet, preparations are made from the sixth to the eighth month for a hair-change, which persists after birth and takes place all over the body. As we, as physicians, are accustomed to pay attention to this only as it occurs on the scalp, we shall now study it up to its completion in this part.

When a child has a very thick, long, erect, and often dark head of hair at birth, *the normal hair-change on the fœtal head has been postponed until after birth.* This long suit of hair on the head of the fœtus consists microscopically of old primary hairs, all seated without papillæ in shortened follicles, and which have sent downwards from their sides productive epithelial processes. They are not ordinary papillary hairs, but "bed-hairs," which have been growing for two months out of the epithelium of the middle follicular region, the "hair-bed." Near the end of intra-uterine life, the epithelial processes produce new young papillary hairs in their interior, after the exact pattern of the primary hair-rudiments, and these, usually before birth, but often after it, supplant the bed-hairs by loosening them from below, growing out of the follicle beside them, and finally causing them to fall out.

The hair-change of the new-born is, therefore, a true interchange between two entirely distinct types of hair. It would be extremely interesting to investigate the question whether the hair-change of puberty, of convalescence, and of different forms of alopecia should also be referred to a similar change in type or are to be otherwise explained.

*Changes of the hairy Coating in the Adult.*—At birth, a relative degree of baldness is found over the whole body under normal conditions. This is at once compensated for, on the head, by the development of the hairs of the scalp, and again at puberty by the growth of the beard in the male sex. The eyebrows and lashes increase very gradually in strength; at puberty, the hairs of the axillæ, and especially those on the mons veneris and around the anus, and finally late in life those at the entrance of the nostrils (vibrissæ) and in the external auditory canal (tragi) follow their example. All the embryonic

hairs of the rest of the body retain as a rule their original size and absence of pigmentation, and constitute the so-called down (lanugo). But in the male sex there often occurs late in life a thickening and lengthening with pigmentation of the short hairs of the head over a varying extent of surface, and in females after the menopause, an increase in growth of the down on the upper lip, or on the cheeks and lower lip.

The great development of other epithelial structures on the distal phalanges of the fingers and toes and on the palms of the hands and soles of the feet seems to hinder the growth of hairs. Even in other parts of the body also, it is a law of the products of the ectoderm that they mutually restrict each other's growth. Thus the epithelial layer of surface is least developed where the hairs are thickest, *e. g.*, on the head, and the finer the hairs the more closely together do they stand.

*Direction of the Hairs.*—The hairs, as we have seen, are as a rule implanted obliquely in the corium. Their direction is dependent upon that of the hair-root, and is, of course, not accidental, but, like the direction of cleavage of the skin, is under the control of general laws of growth, the investigation of which is at present, however, still under discussion.

*Color of the Hair.*—The color of the hair is a product of three factors, viz., the proper color of the hair-cells, the hair pigment, and the air contained in the hairs. The former, according to its intensity, imparts a pale blond or a deep red color. The brownish-black pigment granules surrounding the individual cells of the cortex of the hair impart a more or less brunette tint, varying from a pale brown to an ebony black. The former (horn-color proper) and the latter (pigment color) may unite to produce every shade of color. The external cortex is almost the only one of the layers of the hair which is instrumental in giving it its color ; the presence of a moderate quantity of air in the cortex may give the hair a white color in spite of the fact that its central portion is dark (Pincus). Want of pigment and horn-color renders the hair gray and transparent, and if with this there is associated a large quantity of air in the cortex, the hairs become white and opaque (old age).

Black is the most universal color of the hair, the slightly pigmented blond hairs being found only in the Germans, Celts, Slaves, and Finns, and occasionally in the Caucasus among the Arminians and Semites ; red hair is found only in single individuals of all races.

*Form of the Hair.*—Pruner-Bey has employed the curling of the hair as a means of classification. This is controlled by the shape of the cross-section of the hair, the round hairs remaining straight, while those with an oval or flat cross-section curl themselves over the surface of the skin. The curliest hairs are those of Bushmen and negroes, the straightest those of American aborigines, Polynesians, and Malays. The Aryan race occupies a middle ground between these extremes.

*Histology of the Hair.*—The histology of the hair and its root-sheaths has been much simplified and cleared up by recent investigations.

*Hair-follicle.*—The connective-tissue hair-follicle arises at the bottom of the hair rudiment, and develops from that point in two directions, partly ensheathing the epithelial process, partly indenting it centrally. In the adult, the follicle also is confined to an ensheathing of the lower two-thirds of the hair with its coverings, being lost above the sebaceous glands in the papillary layer. Below the glands, however, it is always well developed. Its external longitudinal fibrous layer is here really only a limiting thickening of the surrounding corium. The middle transverse fibrous layer, on the other hand, is the real foundation of the hair-follicle, and continues alone into the papilla. This layer is abund-

antly supplied with transversely elongated nuclei, resembling those of muscle. It contains no muscles, however, and the transverse position of the nuclei is probably only an effect of the transverse tension of the growing hair. The internal homogeneous so-called vitreous layer is really not an independent membrane, but a condensation of the middle fibrous layer inwardly, which is well developed only in the lower third of the hair-follicle, increasing with the age of the hair, being especially well marked near the end of the papillary stage in the hair-change. A very exceptional development of the vitreous layer I have often found normally in thick head-hairs, consisting in the circumstance that this layer (see Fig. 9) in many closely superimposed spots projected concentrically into the epithelium of the prickle-layer. The cross-sections of these broad ridges of the vitreous layer appear in longitudinal sections of the follicle as blunt or pointed teeth (*z*) of different sizes, which have in their interior fine points, the transverse sections of ring-like circular fibres. Their presence stamps these ridges as folds of a very much hypertrophied vitreous layer. The adjacent portion of the middle transverse fibrous layer is then also usually the seat of a glassy swelling. The vitreous layer does not pass upwards upon the papilla, and is found very slightly, often not at all, developed in the middle third of the follicle. It is always feebly developed in places where young, freely proliferating epithelial cells are seated upon the hair-follicle, and where the vessels of the follicle approach more closely, and it is, on the whole, a very changeable structure, frequently increasing and decreasing.

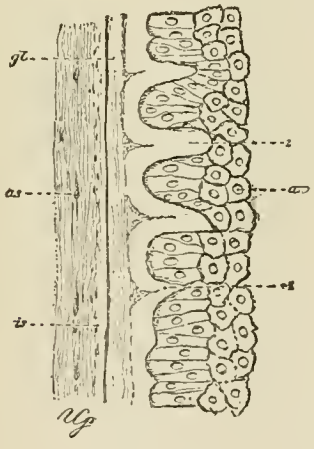


Fig. 9.

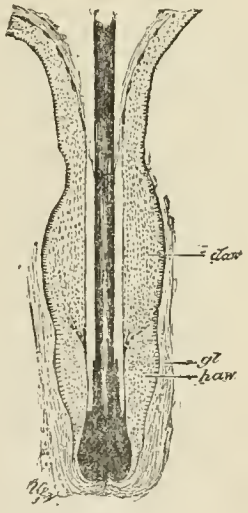


Fig. 10.

Fig. 9.—Senile alterations of the inner sheath of the hair-follicle in head-hairs ; *z*, tooth-like ridges (in transverse section) of the homogeneous membrane, which project into the external root-sheath (*a w*).

Fig. 10.—Senile alterations of the prickle-layer of the hair follicle (so-called external root-sheath) of vibrissæ ; *h a w*, cleared up and enlarged prickle-cells of the lower region ; *d a w*, dark prickle-cells of the middle region capable of good staining.

*Prickle-layer of the Hair-Follicle.*—In order to simplify the complicated nomenclature of the epithelial sheaths of the roots of the hair, we will abandon the name external root-sheath, as it has hitherto been employed, and supply its place by a term which embryologically much better defines it—*prickle-layer of the hair-follicle*—for it is genetically an entirely distinct structure from the *true internal root-sheath.* We shall regard as

coverings of the hair only the epithelial structures *which rise from the papilla in company with the shaft of the hair and grow onward with it.*

The prickle-layer of the hair-follicle has an entirely different character in the three regions of the follicle. In company with the granular and horny layers of the epidermis it sinks into the upper part, the funnel of the follicle. The other two layers, however, terminate simultaneously at the orifices of the sebaceous glands, and from this point the prickle-layer passes on alone through the middle and lower follicular regions, retaining its full thickness as far as the level of the papilla. At this point, however, it grows suddenly narrower, in proportion as the bulk of the papilla increases, and finally, reduced to a single cubical layer, reaches the neck of the papilla. If it be overstained with picro-carmin or other agents which color protoplasm, and decolorized with weak aqua ammonia, it can be regularly demonstrated in mature hairs that the prickle-cells of the middle portion of the follicle take up the coloring agent much more greedily than those of the lower portion. This difference is most pronounced in the vibrissæ (see Fig. 10): in the beginning of the hair-change it can be demonstrated in all the hairs. A further proof of the productive power of this region is furnished by the frequent, almost regular epithelial cones which it pushes out horizontally into the surrounding cutis; this is aided by the slight development of the homogeneous membrane. In contrast to this we always find on the lower region of the follicle in the mature hair signs of senility, such clear prickle-cells, which in the vibrissæ are frequently swollen, and a thick homogeneous membrane.

Inside this hollow cylinder of the prickle-layer, which remains quiescent till the period of the hair-change, the hair now grows freely forwards with its root-sheaths, and from the sebaceous glands on into the funnel of the follicle is already surrounded by the ordinary horny layer. Its root-end surrounds the papilla like a cap; to speak exactly, this root consists of four caps which concentrically cover each other, the first of which (matrix of the root-sheath) and the second (matrix of the cuticle) arise from the neck of the papilla, the third (matrix of the cortex) and fourth (matrix of the medulla) from the papillary layer. All the cells directly surrounding the papillæ of this section are cylindrical cells, from which cubical daughter-cells are constantly thrown off in order to form the hair and its coverings. It is the same complex of cells which formed the primitive hair-cone at the beginning of the hair.

*Root of the hair.*—In order to study the delicate differences between these closely crowded layers of cells, it is essential to obtain a good staining with picro-carmin. A longitudinal section of the root of a thick hair from the beard (see Fig. 11) then shows the following conditions. The matrix of the root-sheath[1] (*m i w*) is externally in contact with the remains of the prickle-layer composed of one row of cells. This matrix consists of from three to six layers of cylindrical cells, which become deeply stained in carmin. Their nearest descendants are characterized by a moderate sprinkling of keratohyalin in the cell protoplasm, and while the entire layer surrounds the papilla like a loop, this substance steadily increases in quantity, in consequence of which the cells become more and more swollen. Meanwhile they arrange themselves in two, or in very thick hairs in three layers. The most external cells of the root-sheath, which are in direct contact with the prickle-layer of the hair-follicle, attain astonishing dimensions just below the level of the apex of the papilla, and appear in longitudinal section as thick square masses, the nuclei of which are completely obscured by coarse granules of keratohyalin with the exception

[1] Formerly internal root-sheath.

of a fine clear border belonging to the outer layer of the cell, which is undergoing cornification. The inner (or the two inner) layer of the root-sheath remains at a somewhat lower stage of the formation of keratohyalin and swelling, and therefore retains the former all the longer. In this way, there is produced just above the level of the apex of the papilla a striking difference in color, the external layer of the root-sheath becoming suddenly

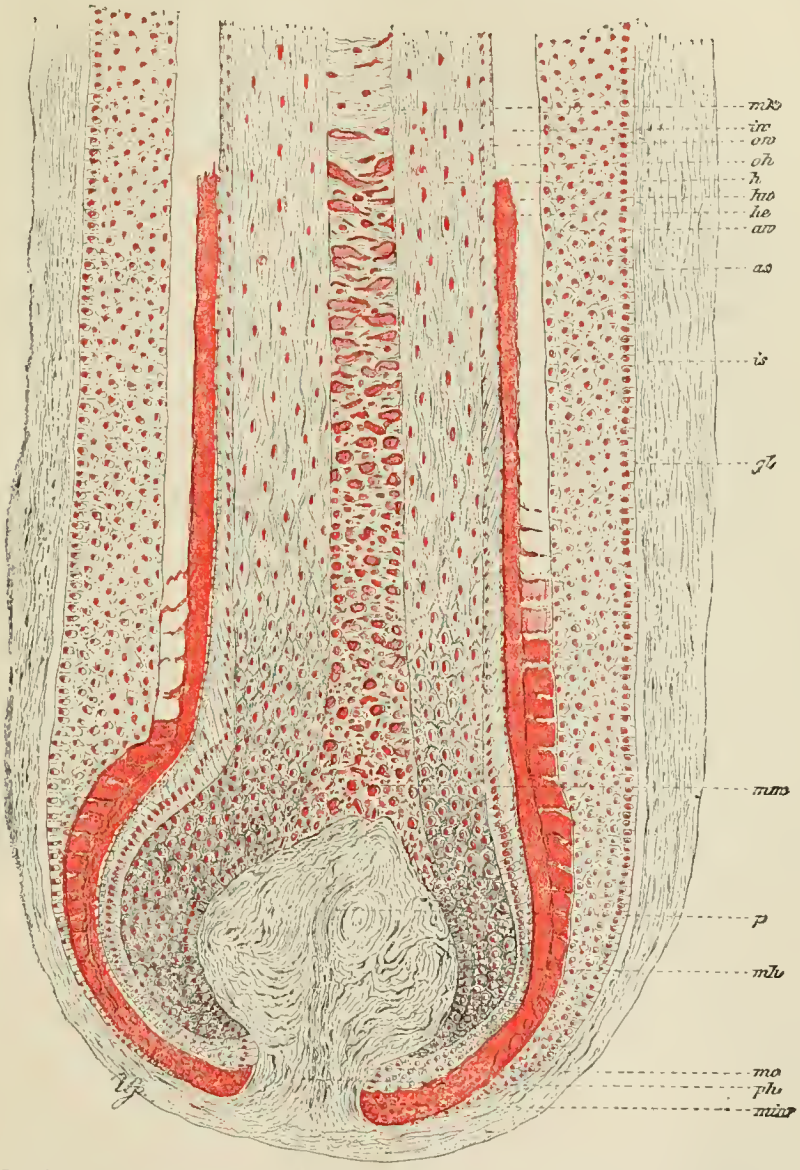


FIG. 11.—Longitudinal section of the root of a hair from the beard ; *a s*, external sheath of the follicle ; *i s*, internal sheath of the follicle ; *g l*, vitreous membrane of the follicle ; *a w*, external root-sheath (better prickle-layer of the follicle); *i w*, internal root-sheath (better root-sheath); *h e*, sheath of Henle (useless term); *h u*, sheath of Huxley (also useless); *o w*, cuticle of the root-sheath ; *o h*, cuticle of the hair ; *h*, cortex of the hair ; *m k*, medulla of the hair ; *p*, papilla ; *m i w*, *m o*, *m h*, *m m*, matrices of *i w*, *o w*, *o h*, *h*, *m k*; *p h*, neck of the papilla.

completely clear, while the internal layer, which contains keratohyalin, still takes on a

brilliant red color. There can be no doubt but that the rapid cornification which the outer row of cells undergoes is due to the counter-pressure of the broad prickle-layer of the hair-follicle, which is suddenly exerted at this point. For when the papilla appears somewhat bent over to one side (see Fig. 11 towards the left), the first clear cell on the bent side always corresponds exactly to the angle of bending, *i. e.*, to the spot in which the breadth of the prickle-layer is suddenly increased by the width of many cells ; while on the convex side, the clearing up of the cells begins a little higher up and takes place very gradually. If we imagine the clear external cellular cylinder of the root-sheath as completely isolated, it would terminate below in the bent follicles, in the shape of an oval body cut off obliquely. This cellular cylinder represents the so-called sheath of Henle (*h e*), but is only the middle portion of the root-sheath which may be artifically isolated. This name (the sheath of Henle) must therefore be abandoned. About twice the length of the papilla higher up, the inner layer of the root-sheath also becomes clearer in a similar manner, forming glassy flakes, and constitutes the so-called sheath of Huxley (*h u*). This name is also superfluous. After the clearing up of the internal layer, they both become more and more like each other as they originally were, and terminate almost as one at the point of junction between the middle third and the funnel of the hair-follicle, where they slowly crumble away cell by cell, without giving evidence of the slightest connection with the horny layer of the funnel of the follicle.

Seen from the surface, the two layers of the root-sheath present differences in the shape of their cells. The outer layer shows next to the cylindrical cells : cubical cells, then hexagonal plates the form of which is due to pressure from all sides, but mainly to centrifugal pressure. These, swelling up as much as their thickness will allow them to, again become large cubical cells. After their nuclei and granules have disappeared, these are transformed into stunted rhomboidal tablets which present an absolutely plane surface towards the prickle-layer, and a convex surface towards the inner layer of the root-sheath. The latter layer presents from below upwards : cylindrical cells, cubical cells, next hexagonal plates which increase slowly in size, and gradually developing from these blunted rhomboids, which inwardly have plane surfaces and outwardly pointed projections, by means of which they wedge themselves in between the arches of the already older, less resisting cells of the external layer. This wedging of the internal into the external layer goes so far that in many places the points of the rhombi, which project upwards, perforate the outer layer, and come into direct contact over small surfaces with the prickle-layer of the follicle. The external layer presents perforations corresponding to these points, which have long been known as the holes of the layer of Henle. When we reflect that on the periphery of the papilla the outer layer must ascend more rapidly than the inner, on account of its excessive distention by keratohyalin, but that they become intimately re-united in the middle portion of the follicle, it follows that the inner layer must at some point be arrested in its advance by the outer. This takes place under the above-mentioned pressure phenomena, and is effected by the gradually increasing entanglement of the inner in the outer layer. *The root-sheath, therefore, springs as a unit from the neck of the papilla, and immediately divides into two layers which become temporarily disarranged in their relations to each other, because they contain different quantities of keratohyalin. But finally, being once more re-united by pressure from without, they crumble off as a whole at the neck of the follicle.*

Between the matrix of the root-sheath (*m i w*), which contains keratohyalin and the mother-cells of the cortex of the hair (*m h*), which contain pigment, and also on the neck of the papilla, there is found the common matrix (*m o*) of the two cuticulæ, which

is clear, and contains neither keratohyalin nor pigment. This matrix also consists of several (three to five) layers of cylindrical cells, which under the pressure and counter-pressure which prevails at this point, at once arrange themselves in two layers, the cuticle of the root-sheath and the cuticle of the hair. They present very different appearances at the broadest part of the papilla, the cells of both being much elongated in a direction vertical to its axis, those of the cuticle of the root-sheath being placed with their long axes parallel to the circumference of the hair, while those of the cuticle of the hair stand perpendicularly upon its surface, like the teeth of a wheel. On a longitudinal section (see Fig. 11), only very small cross-sections of the cuticle of the root-sheath are seen and much larger longitudinal sections of that of the hair. The latter radiate like a beautiful, clear cylindrical epithelium over the greater part of the surface of the papilla, from the pigmented matrix of the cortex of the hair, so that below the broadest part of the papilla the cells of the cuticle look downwards, upon the papilla itself horizontally outwards, and above it upwards. Still higher up, these cells of the cuticle are directed still more vertically, so that they finally form very acute angles with the upright cells of the hair. They show by this upward direction of their outer ends that they are held fast inwardly, next to the hair proper, while outwardly they are in contact with a more rapidly ascending structure, *i. e.*, the root-sheath with its cuticle. While, therefore, the external layer of the root-sheath grows faster down in the follicle than the internal, they both together advance more rapidly than the cuticulæ which contain no keratohyalin. The outer cuticle escapes the gradual erection by the narrowing and lengthening of its cells in a circular direction; this change first shows itself in the cuticle of the hair, whereas the cuticle of the root-sheath is pressed more and more closely against, and becomes fused with it.

At the same level on the follicle, a little above the apex of the papilla, where, as we have just seen, the inner layer of the root-sheath is pressed into the outer, the strong radiating pressure inside the cuticulæ manifests itself by the interlocking of the internal by its straight cell-edges under the overhanging cell-edges of the external. On a longitudinal section, this produces the impression of the teeth of a balance-wheel, and, in fact, as v. Ebner first stated, the hair must at this point be held back by the root-sheath, or to speak more accurately, *both root-sheath and hair must for a certain distance be pushed with equal rapidity out of the follicle.* But only for a short distance, the extent of which can be best estimated on a hair that has been extracted. Just as far as the projecting edges of the cells of the cuticle of the hair are everted during the process of extraction, by the edges of the cells of the cuticle of the root-sheath which were interlocked with them in the lower half of the middle third of the follicle, just so far, of course, the root-sheath acted as a clog upon the hair (see Fig. 13, A III. and B III.).

At a point higher up, both the cuticulæ, which are here undergoing cornification and becoming narrower, separate more and more widely, the wholly cornified and thinned root-sheath no longer presses so closely upon the hair, the restraining cell-edges become less and less closely interlocked, and the hair, freed from its clog, grows upward more rapidly than the root-sheath. While, therefore, the layers of the root-sheath, although temporarily separated, finally become firmly re-united, those which originate in the common matrix of the cuticulæ, after being temporarily interlocked, become permanently separated. One part of them unites with the root-sheath, another with the hair. If the hair during its development breaks through the root-sheath, the separation takes place inside the cellular cylinder, which was originally a unit.

The matrix of the hair proper (*m h*) occupies the entire body of the papilla, and

again divides sharply into the pigmented cells of the hair-cortex and the non-pigmented cells of the medulla, which contain keratohyalin and occupy the exact apex of the papilla. The cells of the hair-cortex, the hair-cells proper, are from the first inclosed in masses of granular pigment, are cut off as cubical cells from the cylindrical cells, and are gradually transformed by the pressure exerted upon them into long, narrow fibre-cells, the nuclei of which are also flattened and elongated, and which leave many vertical air-spaces between them. Waldeyer has recently discovered that the younger hair-cells are composed of real fibrilla, such as we elsewhere find only in the connective tissue.

The innermost medullary cylinder, in marked contrast to the vertically elongated cortical cells, consists of horizontally broadened epithelial cells. No true cylindrical cells can be found in the matrix of the medulla. An irregularly cubical epithelium (*m m*) covers the apex of the papilla, characterized by the presence of large globules of keratohyalin, only one or two of which are found in each medullary cell. These become much more deeply stained in carmin than the round nuclei near them. Higher up, the medullary cells, which are at first arranged in irregular layers, collect into a rouleau-like column of cells, having three or four cells in a horizontal plane. The globules of keratohyalin gradually take less and less of the carmin color while they increase in size; afterwards they seem to become entirely dissolved in the cell protoplasm, while the nuclei shrivel up.

Finally the whole of the medullary cells shrink, and leave at first narrow air-spaces between them, which afterwards grow wider, so that in the middle follicular region they are surrounded by a complete system of air canals. Air does not penetrate into the interior of the cells.

The shape of horizontal plates, which the medullary cells assume, can only be the result of a pressure exerted upon them from above downwards. When we reflect that in the fœtus, and during the new-formation of hair, the hair-shaft is at first always non-medullated, and that the medulla grows into a closed horny mass, the origin of this pressure is readily understood; an uncut hair always has a non-medullated end.

Very curious, however, are the boundaries, so sharply defined according to the cell-layers, of the individual concentric layers of the hair, which are so distinctly characterized chemically and morphologically. We must assume that, in obedience to the action of regularly working mechanical forces (which we have just attempted to sketch in outline) the different kinds of layers of the hair are developed out of the originally always homogeneous material which covers the papilla.

Leaving the details of this process to subsequent investigations, we can at present only say that *in the lower third of the follicle, the hair proper is overtaken by the more rapidly growing root-sheath,* that the latter is then suddenly arrested in its course, and a check is thereby suddenly brought to bear on the hair; so that, *in the middle follicular region, both hair and root-sheath must for a time grow with equal rapidity. A little later, however, the hair gains the upper hand, and the root-sheath, left behind in the race, crumbles off in the funnel of the follicle somewhat more slowly than the hair-shaft grows upwards.* The primarily more rapid growth of the root-sheath is, in my opinion, due to *the excessive formation* of keratohyalin, which may in some way be dependent upon the unfavorable situation of its matrix in respect to nutrition.

*Papillary hair. Bed-hair.*—We have thus described the mature continuously growing papillary hair. It is always characterized by the presence of a medullary cylinder in its interior, which reaches down to the papilla, by the peculiar formation of the cuticulæ and root-sheath, and finally by the uniform distribution of the pigment around the cells

of its cortex. All these peculiarities are direct consequences of the presence of the papilla. We are familiar with another variety of hair-shaft, constructed in an entirely different manner, having neither papilla, root-sheath, cuticulæ nor medulla, and whose pigment is not uniformly distributed, but is scattered in heaps and strands throughout the hair. This variety, the *bed-hair*, never arises independently in a hair-follicle, but is always an annex to a papillary hair which originally grew there.

As it seems particularly adapted to give us an insight into the pathological disappearance and change of the hair, it seems advisable to carefully distinguish it from the papillary hair as *a special variety of hair*. From a theoretical standpoint, indeed, a hair is that cylinder which grows out of a hair-follicle, and all the pieces cut off from this cylinder, from its origin on, belong to "one hair." With such a conception of *virtual* hairs, there can of course be no bed-hairs, but only a bed-hair stage of each individual hair, which always produces the last part of the hair, that nearest the skin. From a practical standpoint, however, we do not have to deal with whole, virtual hairs, but partly with such as have been pulled out, and which consist of a portion of the shaft of varying length and of the root, and partly with sections of the skin which show only the root and an extremely small portion of the shaft. These, for the sake of simplicity and convenience, we shall distinguish as *papillary hairs* and *non-papillary bed-hairs*.

*Hair-change*.—A comprehension of the bed-hair can be obtained by a careful study of the *hair-change*. The term "hair-change" comes from the fur of certain animals in which the old coat of hair is periodically cast off and replaced by a new one. It is therefore hardly correct to speak of a hair-change in man, who is constantly losing single hairs and getting new ones. But since a recognition of the bed-hair necessitates a kind of hair-change, and even more, *a change in the type of hair*, in the human subject, and as this, acting backwards, will lead us to a clear understanding of the periodical hair-change in animals, we shall maintain the occurrence of a hair-change in man.

The hair-change consists in the separation of the papillary hair from the papilla and its ascent in the follicle, though only as far as its middle region. Here it remains, being firmly united with the prickle-layer, and growing out from it as a bed-hair. After an indefinite period, it sends out into the more or less collapsed lower portion of the follicle, or, more rarely, into the adjacent corium, a young epithelial process from which a young hair is developed. This grows out of the old follicle, by the side of the bed-hair in many instances, but usually after having loosened and pushed it out. The hair-change may be indefinitely arrested in the bed-hair stage or even permanently. In the adult, no young papillary hairs are produced without preceding bed-hairs.

In Fig. 12, I have represented a complete hair-change in the rapidly-growing eyelashes. *A*, *B*, *C* show the separation of the old papillary hair from its papilla, and its transformation into a bed-hair, *D*, *E*, *F*, *G*, the sending out of an epithelial process by the latter, and the development of the young papillary cilia. In *A* we see the hair-root already separated from the papilla. The latter is surrounded by indifferent cells directly continuous with the prickle-layer. It has retained its original size, but the hair-follicle already presents a narrowing at its lower extremity, the whole epithelial cap of the hair-root having been drawn off from the papilla. Preparation has long before been made for the removal of this cap by the thinning of the matrix of the root-sheath and the cuticulæ, which arise from the neck of the papilla. These coverings are therefore the first to suspend their growth during the hair-change, and their cornified portions are the first to be lifted upwards; they are next followed by the outer parts of the cortex, then the inner. The cap of the hair-root is consequently lifted from the papilla in a direction

the reverse of that in which it grew around it; it is *lifted off*, in the true sense of the word, not pushed off, and therefore the hollow cap must revert to its original condition

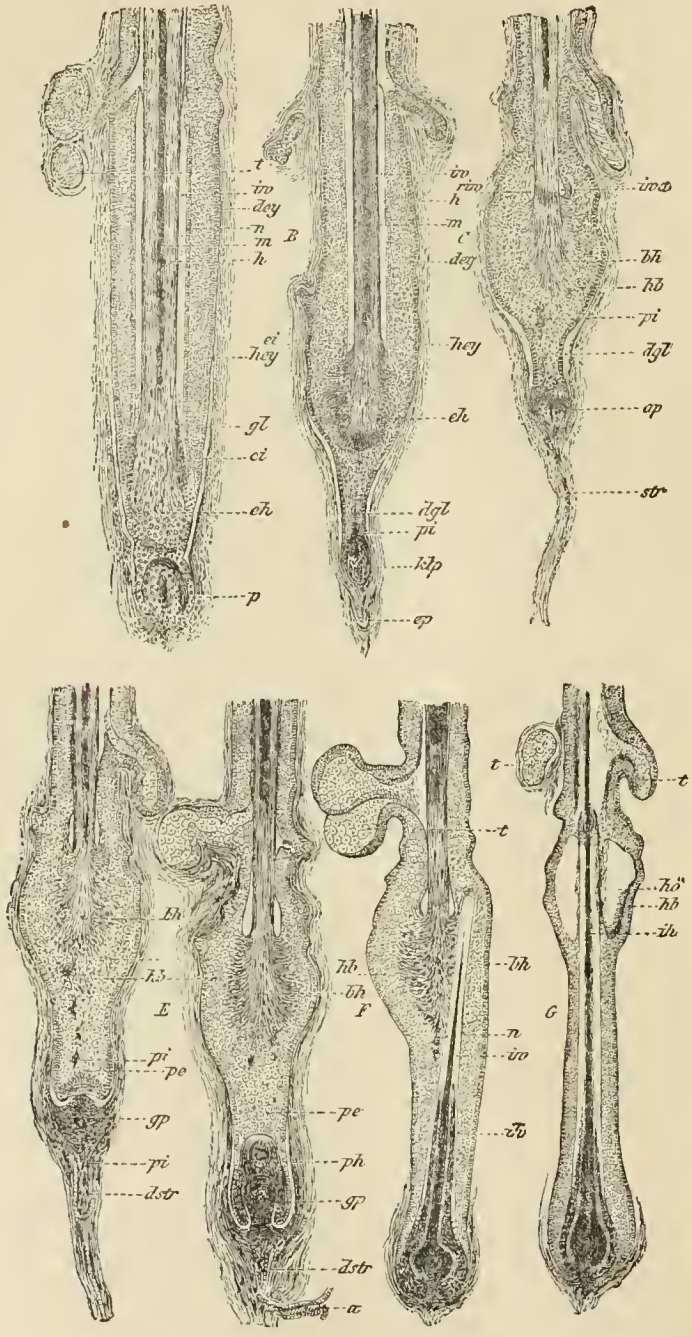


FIG. 12.—COMPLETE HAIR-CHANGE IN THE EYELASHES.

*A*, *B*, *C*, loosening of the old papillary hair and its transformation into a bed-hair; *D*, *E*, *F*, *G*, formation of a productive epithelial process by the hair-bed and development of the young papillary hair; *t*, sebaceous gland; *n*, layer

of cells which I formerly called "neutral," between the internal and external root-sheath, of no importance for the hair-change; *g l, p, m, h, i w, a w*, as in Fig. 7.

*A*, separation of an old hair from its papilla; *e h*, button-shaped end of the hair; *e i*, almost entirely cornified end of the internal root-sheath; *h c y*, cleared up cylindrical cells of the lower third; *d c y*, dark granular cells of the middle third, capable of deep staining.

*B*, old papillary hair growing upwards; *d g e*, thickened vitreous membrane; *e h*, broom-shaped end of the hair, still very distinct; *e i*, spur-like end of the ascending internal root-sheath; *k l p*, papilla lessened in size; *p i*, pigment; *c p*, capillaries of the collapsed hair-follicle.

*C*, transformation of the papillary hair, which has reached the middle region of the follicle, into a bed-hair; *r i w*, remains of the internal root-sheath; *i w a*, inner root-sheath fallen out; *b h*, bed-hair produced by the penetration of the productive prickle-cells into the old hair bulb (*e h*, 12, *B*), not sharply separated from the external root-sheath, which has in this place, the middle region of the hair-follicle, become changed into a sack-like body, the hair-bed (*h b*); *p i*, pigment; *d g l*, very much compressed and thickened vitreous membrane; *a p*, papilla much atrophied; *s t r*, lower third of the follicle contracted into a long cord.

*D*, bed-hair, which sends out a new productive epithelial process; *p e*, productive epithelial process; *g p*, papilla increasing in size while being pushed downwards; *d s t r*, band of connective tissue which is undergoing thickening and vascularization while the papilla descends, much pigment being meanwhile formed; *h b, b h, p i*, as in *C*.

*E*, first rudiment of the young hair; *p h*, primitive hair-cone, cornified at its apex, showing swollen cells in its interior; *a*, a small artery which passes into the hair-strand; *d s t r*, very much thickened old hair-strand, out of the elements of which a lower portion of the hair-follicle is reformed by the extending epithelial process.

*F*, young cilia, still hidden under the bed-hair; *i h*, young cilia; *b h*, old bed-hair; *h b*, hair-bed still more sharply-defined towards the old bed-hair, the latter becoming loosened by the pressure of the young cilia.

*G*, young cilia, after the shedding of the old bed-hair, growing free in the old follicle, which contracts firmly around it; *h o*, cavity left after the falling out of the bed-hair, with a button-shaped end; *h h*, mural epithelium of this cavity (the former matrix of the bed-hair), which, while proliferating, gradually applies itself to the young hair as the prickle-layer of the middle region of the follicle; *i h*, young cilia.

as a solid rounded epithelial button. Such is the shape of the end of the hair immediately after it has been loosened from the papilla (*e h, A*), and it is also more transparent, longitudinally striated, and can be easily distinguished from the mass of rounded indifferent epithelial cells into which all the cells are, without distinction, resolved.

At *e i*, we see the cornified end of the root-sheath which has already advanced a certain distance upwards. In the prickle-layer, the middle region of the follicle presents cylindrical cells, which stand close together and become deeply stained (*d c y*), while those of the lower follicular region are clearer and larger (*h c y*), and are seated upon a very thick vitreous membrane.

In *B* the end of the hair has ascended still higher in the follicle, and has lost its button shape, the proliferating cells of the middle follicular region passing into it from all sides. The spur-like end of the root-sheath has also ascended the same distance upwards. The lower follicular region is much more collapsed, and now contains only a column of old epithelial cells, and at its bottom the papilla already much diminished in in size. The wall of the follicle presents the following conditions: while the external longitudinal layer shrinks into a cord below the ascending papilla, the middle layer contracts with the papilla around the ascending end of the hair. The vitreous membrane, which cannot become elastically shortened with them, is in part much thickened (*d g l, B*), and in part thrown into folds.

In *C*, the end of the hair has already reached the upper part of the middle follicular region just below the sebaceous glands. The broom-like fibrillation has still further increased, and the prickle-cells of the walls of the follicle stream in still greater numbers into it. The root-sheath has mostly disappeared, at *i w a* entirely; at *r i w* the last spur-like extremity is still visible, and around it the prickle-cells of the wall of the follicle lying a little higher up still pass into the *bed-hair*. By this term, we may now designate the hair, while we give the name *hair-bed* to the productive portion of the prickle-layer of the middle follicular region from which it grows.

*Hair-bed.*—The hair-bed is prolonged downwards into a short process of old epithelial cells, which is still indented by the remains of the old papilla, and is surrounded by

a thick vitreous membrane. The middle layer of the follicle has therefore become still more shortened, the papilla having undergone extreme atrophy, and the external layer has shrunken into a long cord (*s t r*), in which very tortuous vessels run.

The medulla of the hair also merits special consideration in the hair-change. Its growth ceases even before the epithelial cap has been stripped from the papilla. This seems perfectly natural, since, as we have seen, an exceptionally great pressure from above downwards is essential to its growth; the first cessation of this pressure in the beginning of the process of loosening of the hair is followed by the arrest of the formation of the medulla. For this reason, the latter does not extend as far as the end of the hair after it is loosened (see *A*). In this situation it is pushed upwards with the hair (see *B*), until the latter has reached its permanent destination. At this point, however, the old medullary cord is again arrested, only cortical cells being furnished by the hair-bed. Thus a non-medullated cylinder is formed, directly continuous with the old medullated one, the so-called "clear root-end" found on the hairs pulled out at this stage of their growth.

The non-medullated shaft of the bed-hair has no cuticle and also lacks a root-sheath. It represents in the form of a cylinder a variety of cornification which we have already encountered in the nail. Just as in that case, the transformation of the prickle into the hair-cells is brought about by the intervention of a zone of cells with distinct prickles, but destitute of keratohyalin.

In *D* we see a thick young proliferating process extending downwards and capable of being deeply stained. This is already indented by a small papilla. The old connective-tissue cord upon which it sits is much thickened and provided with large vessels, which lead to an abundant formation of pigment. This finds its way into the epithelial process, the hair-bed, and finally into the bed-hair itself. Unlike the pigment of the papillary hair, it forms thick lumps and columns, which wander upwards in the epithelium with the current of fluid.

In *E* the young epithelial process has grown still further downwards and is still more indented by the much enlarged papilla, which has already been pushed downwards, almost to the bottom of the old follicle. Upon the papilla, the neighboring epithelial cells have formed themselves into a cone the apex of which is already of a horn-like transparency. As yet, there is no separation into shaft and root-sheath, and in the centre of the cone there is a peculiar cavity, the signification of which is still obscure. At *a* we see a large artery entering the much-distended old cord. The young epithelial process in *D* and *E* is no longer bounded by a vitreous membrane, but comes directly in contact with the middle sheath of the follicle.

In *F* a small mature cilia has already developed from the primitive hair-cone. This, still covered by the root-sheath, has grown up by the side of the bed-hair in a lateral direction. The young cilia is entirely surrounded by a layer of very regularly cubical cells, which become somewhat more deeply stained by carmin than the surrounding prickle layer.

*G* shows the end of the whole process. Here the young cilia has not only loosened the bed-hair, but pushed it out of the follicle. The new papillary hair passes freely through the cavity thus produced, which has already much diminished in size. In a short time, this cavity will have also disappeared, in consequence of the proliferation of the prickle-layer which applies itself closely to the constantly thickening new hair.

If we cast a glance over these stages of the hair-change, it will be seen that *C* and *D* might easily be confounded with each other. It may well be asked how, and in fact

whether, one can always distinguish an old retracting epithelial process from a young proliferating one. Theoretically speaking, this ought to be easy. As a matter of fact, however, the distinction between them is not always so readily made as in the preparations from which figures *C* and *D* were taken. There is one absolutely reliable criterion, however, which it is unfortunately hard to avail ourselves of, on account of the smallness of the cells in question; viz., in the young epithelial process signs of division of cells must be visible under proper treatment, which is not the case in the old one. In the human subject, the old process is never wholly drawn in (as is common in animals), and the remains of the papilla very seldom disappear entirely. The formation of the young process must therefore be regarded as an evidence that the remains of the old one have become productive. The cylindrical cells of the latter again produce young epithelial cells, and the whole process, therefore, increases in length and breadth, and forms a papilla out of the resisting connective tissue by growing around it like a cap.

Much discussion has also been carried on as to whether the young hair grows upon a new papilla or upon the old one. I prefer to call the enlarged papilla a new one, although, or even because, I do not attach to this new-formation the importance which is usually ascribed to it, writers not yet having freed themselves from the notion of an independent growth of the papilla. The new-formation is really nothing more than a passive marking-out or isolation by the formative epithelium of a portion of the corium, and it can, therefore, just as well take place upon an old papilla lessened in size, as a basis, as without one.

Not in all parts of the body, however, does the young epithelial process always find and dilate the lower portion of the old sheath of the follicle, as here in the case of the ciliæ. Thus it often happens on the hairs of the beard that the young process makes an independent path for itself, after the end of the old follicle has become occluded; in the very straight follicles, on the other hand, the reopening of the old follicle is the rule (as in the ciliæ and vibrissæ). In the ciliæ, moreover, the growing hair-bed often sends out horizontal epithelial cones into the corium, which may become the starting-points of oblique hairs (trichiasis, distichiasis).

*Growth of the Bed-hair.*—The greatest interest is, of course, associated with the continued *independent growth of the bed-hair*, which has thus far encountered much doubt. It is based upon the following facts. In the first place, the direct gradual transformation of the prickle-cells into the shaft of the bed-hair can be followed just as easily on thin sections as the transformation of the same kind of cells into the nail-cells on the matrix of the nail. For this reason I believe that a real addition is first made to the hair at the point at which it enters the middle productive region of the follicle. As long as the ascending hair is still in contact with prickle-cells which have become transparent, I can find no direct transformation of the cells. This can be very distinctly seen in the vibrissæ.

In the second place, granular pigment travels from the vessels of the connective-tissue cord into the epithelial process and the hair-bed; thus far it can and must have been carried by the current of lymph. But as it ascends still higher in the hair-bed, the prickle-cells of the follicle must, in view of the absence of further lymph-channels, have become the hair-cells of the bed-hair.

In the third place, when the bed-hairs are pulled out, they always carry with them a portion of the hair-bed and the entire zone of transition. This would be impossible if the bed-hair simply represented a dead hair loosened from its matrix.

In the fourth place, the hair-bed constructs a hair-shaft of its own of a much simpler pattern, which cannot be likened to that of the papillary hair. The papillary hair always forms medullary matter, and the non-medullated hairs are not papillary hairs. This does not exclude the possibility of medullary matter being absent in very limited portions of the papillary hair.

In the fifth place, the number of the bed-hairs is so large in many parts that it is impossible to

regard them all as hairs that have just fallen out, particularly in view of the fact that, on the scalp where a much larger number of hairs are shed, not near so many bed-hairs are found. Mähly found among the one hundred and fifty hairs on one upper eyelid thirty papillary hairs, fifteen transitional forms, and the enormous number of one hundred and five bed-hairs (bulb-hairs), and he, therefore, estimated the average age of the papillary hairs at thirty days, and of the bed-hairs at one hundred and five days,[1] a conclusion which does not seem to me to be everywhere applicable. I found on the ciliæ of young persons that only about the fourth or the fifth part consisted of bed-hairs, and in an old person, on the other hand, that more than three-fourths of all the ciliæ were of this character. If one wishes to obtain quickly a large number of bed-hairs, it is necessary to insert all the fingers into the beard, and to exert only a very moderate traction. In this way almost only bed-hairs are pulled out, as they are, of course, by no means so firmly implanted as the papillary hairs, which have their own restraining apparatus. Under the chin, however, bed-hairs are almost never obtained, even by the first method. These and other constant topographical differences cannot be reconciled with the view that the bed-hairs are simply cast-off papillary hairs.

Entirely without foundation, on the other hand, is the difficulty often encountered, especially by histologists, of comprehending the fusion of horny masses of different origin. This has long been a familiar matter to practical physicians, as entirely analogous phenomena may readily be observed on the nail. The end of the ascending papillary hair is only a still uncornified mass of prickle-cells, to which epithelium from any other source may become attached by means of the prickles, in order to undergo a mutual cornification, just as the prickle-layer grows together from all sides over a loss of substance in the skin, and undergoes cornification.

Another objection refers to the hair-bed. Schulin has justly remarked that the diverticula from the middle region of the fœtal hair-follicle, which I was the first to describe, correspond to the region, and in the case of the button-like swellings, to the very spot to which the arrector pili is attached. He believes that he has settled the matter by this simple statement, and entirely overlooks the fact that no arrectors whatever are attached to the vertical hairs, *e. g.*, those of the nose, although the spindle-shaped dilatations of these are much larger, and the latter could never be explained by the one-sided traction of an arrector. I have ascribed so great an importance to the diverticula and swellings on the embryonic hairs only for the reason that, in view of the yielding nature of their follicles, they give us a vivid notion of the productivity of the middle follicular region, which, in the case of the firmer follicle of the adult, can often be made out only by its greater capacity for being stained.

*The Hair-Change a Change in Type. Explanation of it.*—The entire hair-change, therefore, consists in a change in type, both types being connected with one and the same follicle. But as one of the hairs loosens and displaces the other, there must be a certain opposition and competition between the two areas from which they spring, and this we find in fact to exist between the middle and the papillary region of the follicle. It is primarily mechanical; the hair-cone arises from the papilla and presses from all directions against the prickle-layer of the follicle, which therefore usually remains unproductive. It must, however, where it is possible for it to do so (especially in the fœtus), distend the follicle externally, and in all cases exert a centripetal pressure upon the hair-cylinder in its interior. As regards the sources of nutrition, we see, on looking at Fig. 1, that the subsequent subpapillary vascular network is represented by very fine horizontal branches which run just beneath the epithelium, and by much larger parallel branches, situated a little lower down, which surround the three follicles with bed-hairs, exactly in the zone of the middle follicular region. Below this point, the follicle is not so well supplied, until the papilla which indents the epithelial process shows that it is placed under circumstances more favorable to nutrition, by having its own capillary loop. The large and small horizontal branches which at this point are still separated, subsequently unite to form the subpapillary network, which sends down a small vascular

[1] Mähly, quoted in Virchow-Hirsch's Jahresbericht.

plexus to the middle region of each follicle. In consequence of this arrangement, the middle follicular region participates in the disturbances of the papillary circulation, while the capillary loop of the papilla is comparatively independent of it, but shares the fate of the circulation in the deeper parts of the skin. From these facts, it will be at once understood that every interference with nutrition which begins at the papilla and every increase in the papillary circulation must produce a preponderance of the middle over the lower follicular region. This can find expression only in the growth of the prickle-layer at the former point, and an increase in the pressure upon the hair internally, and must be followed by atrophy of the hair-cylinder, or by its being lifted off from the papilla and forced out of the follicle. We have already seen that the hair is in fact lifted off from the papilla, by a force which attacks it from without. The outer layers are lifted before the inner, the root-sheath ascends before the hair; in this way, the epithelial cap is again made to assume a bulbous shape. The much discussed *first incitement to the hair-change is therefore furnished by the circulatory preponderance, the stimulated productivity of the middle region of the follicle.* The general tension of the corium may possibly favor the expulsion of the hair, but, as a rule, we can ascribe but little influence to it.

It will also be readily understood that, as soon as the cornified shaft of the hair has passed by productive epithelial cells, they will penetrate into the succeeding softer layers and unite with them, and that finally the arrest of the old hair will continue as long as the disturbed preponderance of the circulation of the middle follicular region has not been equalized, *i. e.*, until all the productive epithelial cells of the wall of the follicle have found space and opportunity to grow upwards behind the hair-shaft. It is now all at once clear why the hair ascends only as far as the upper border of the productive region, *i. e.*, to just below the sebaceous glands, and no higher. The productive capacity of this region has then just found a satisfactory opportunity to exert itself.[1] Just as soon as the pressure prevailing at that point is lessened by the lifting-off of the hair from the papilla, all the varieties of cells found around the papilla become transformed into indifferent prickle-cells, and the follicle contracts elastically around the shortening epithelial process, compressing and folding up, meanwhile, the inelastic vitreous membrane. The second part of the hair-change, the sending-out of the young epithelial process, requires no explanation. The third part comprises the regaining of the old follicle, the formation of a new papilla and a new papillary hair, and it is not impossible that this new production may gradually come to exert a derivative influence upon the nutrition of the middle follicular region. The fourth part consists usually in the expulsion of the bed-hair. With regard to this, stress has recently been laid upon external mechanical influences as causes, although I had shown that the regular falling-out of the hair in ovarian cysts and in utero stamped all external causes as incidental. The real cause of the shedding of the hair is in all cases the growth of the young papillary hair. The bed-hair can be pulled out by slight traction only after it has been loosened by the papillary hair. In this case also, after the removal of the bed-hair, the follicle contracts elastically around its diminished contents.

*Histological Explanation of Clinical Facts Bearing upon the Hair-Change.*—In the light of the theory of the hair-change here advanced, many of the questions which are so enigmatical from a clinical standpoint are already becoming clear. Here are only a few hints:

[1] I gave expression to this theory in a short note, in 1875, which Schulin seems to have overlooked.

In the first place, it was a singular fact that the individual occupants of the hair-circles first recognized by Pincus (*i. e.*, the groups of from three to five hairs, separated by large free interspaces), are not only in different stages of development, but also vary greatly as regards their thickness, length, and longevity. The difference in the stages of development is determined from the beginning by the different periods at which they arise. The difference in dimensions is readily explicable on the basis of the theory of the change in type, that the hair-germs which at different periods ascend and descend, differ more and more widely from each other; that the hairs, according to either local or general influences, retire to varying distances on the hair-bed, that they again reach the bottom of the follicle with varying degrees of completeness, that they send out in one place thick, in another thin epithelial processes, which produce thick or thin hairs, according as they are indented by narrow or by broad papillæ, in one place rapidly displacing the bed-hair, in another growing quietly out of the follicle beside it. The time of life, the temporary constitution, and more especially, pathological processes of the corium, must exert an influence upon the activity of these processes and the period at which they occur, and must thus necessarily bring about a great variety of forms, which are succeeded by a uniform type only in old age. Directly applicable to the theory of the hair-change on the scalp are the investigations of Pincus of the varying condition of the lower end of the root of the hair (his "altered root-end" corresponds exactly to our bed-hair stage). He states that "the longer the term of life to which the hair was predestined, the longer is the root-piece." He finds that in the normal outfall of the hair, the altered root-piece is one-third the length of the entire hair in seventy-seven per cent of all those that are cast off, or, in other words, a third of the entire length of the hair, and (in view of the much slower growth of the bed-hair), a still greater proportion of the *length of life* of the hair is occupied by the bed-hair stage. The number of the hairs in which the root-ends are not thinner, but of the same thickness as the rest of the shaft, is four or five times smaller than the proportion given above, and but few hairs can be found in the normal outfall the root-ends of which are thicker, and at the same time darker. Here we encounter a great gap in our knowledge, since we do not as yet know whether or not papillary hairs are also pulled out during ordinary combing. Only after this has been determined can the result arrived at by Pincus become perhaps of great value, viz., that in acute diseases of the hair, the relation between the thin and the thick root-ends is almost reversed. The term "pointed hairs," applied by Pincus to those which, even when the hair is worn short (four or five inches) fall out from the scalp before the scissors reach them, and which have therefore the same significance in men as the short hairs (under six inches) in the outfall of women who wear their hair long, is of course only an arbitrary one. But even with this limitation, it has already furnished us with useful average estimates. According to Pincus, at most a fourth part of the outfall of the hair in women is, under normal conditions, under six inches in length, and in that of men, at most a fourth or fifth part consists of "pointed hairs." The existence of the "pointed hairs," particularly of those from the borders of the hair of the scalp, shows that the boundaries between the typically long and the typically short hairs are not fixed, and always become changed during the normal hair-change. A hyperæmia of the papillary circulation may suddenly give the middle follicular region a great preponderance over the others, and thus induce a general change in type from papillary to bed-hairs, which after a time manifests itself as a universal defluvium, *i. e.*, a general expulsion of the bed-hairs by the young after-growth of papillary-hairs (defluvium of convalescence).

We can only hope that in the future the clinical aspects of the subject may be completed by a more exact classification of the stage of the hair change, which can always be studied on the root-end. For this purpose I reproduce in Fig. 13 a few of the principal types of torn-out hairs. Fig. 13 *A* exhibits two perfectly regular ones. I. represents a bed-hair from the beard; we see the zone of transition, the hair-bed which was partially extracted also, and the remains of the epithelial process. Higher up we see the spur-like cavities into which the ends of the root-sheath were inserted, and, finally, high up on the shaft the beginning of the old medullated papillary hair, the shaft being distinctly broader at this point. II. shows a bed-hair from the scalp, seen from the surface, its end looking not unlike a pine-cone; the shaft is perfectly clear, and (a proof that it is an old bed-hair) there is no medullary matter whatever in it. I shall call the roots of the bed-hairs (as in 13 I. and II.) *full roots*, and those of the papillary hairs *hollow*

*roots* (13 III.). On the hollow root (13 III.) we see, in the first place, the depression in which the papilla was seated ; next, in direct contact with it, the medulla, which contains air higher up ; and then the everted edges of the cells of the cuticle, seen from the surface.

In 13 *B* rare and irregular forms are represented. I. shows a hair from the head which was torn out in the beginning of the outfall, and, therefore, has the loosened root-sheath attached to it. The end of the hair has become clear, and is provided with an

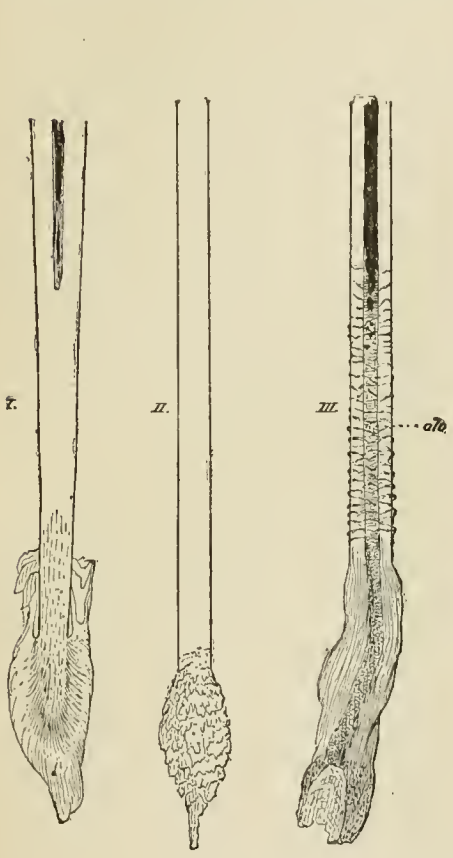


FIG. 13 *A*.

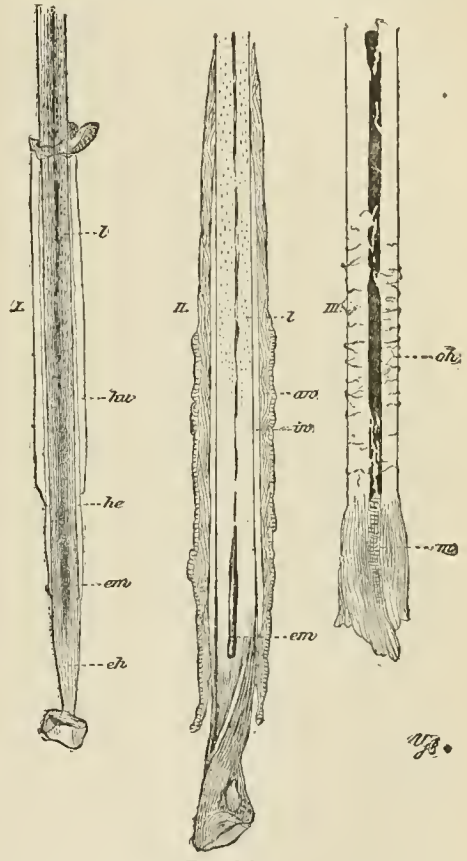


FIG. 13 *B*.

EXTRACTED HAIRS.—*A*, types of such ; *B*, rare and irregular forms.

FIG. 13 *A*—I. Bed-hair of the beard. The middle surface in focus.

II. Bed-hair from the head. Surface in focus.

III. Papillary-hair from the head ; *o h*, everted edges of the cells of the cuticle of the hair seen from the surface.

FIG. 13 *B*—I. Hair from the head which has fallen out ; *e h*, cleared up and narrowed end of the hair, still covered with a thin cap for the papilla ; *h u*, Huxley's portion ; *h e*, Henle's portion of the inner root-sheath which has ascended ; *e m*, end of the medulla, containing air and showing a vesicular dilatation ; *l*, bubbles of air in the cortex.

II. Hair extracted with the external root-sheath ; *a w*, so-called external ; *i w*, so-called internal root-sheath ; *e m*, as in *B* i.

III. Hair the root of which has been torn off, and in part left behind in the follicle ; *o h*, everted cuticle (the centre of the hair in focus) ; *m*, young medulla, containing no air.

atrophic cap for the papilla. The medulla begins with a vesicle-like dilatation of its end (*e m*), probably produced during extraction. We distinguish the two layers on the root-sheath, the outer of which has advanced higher up on the hair (*h e*) than the inner

(*h u*). The cortex contains oblong bubbles of air. II. shows a hollow root, which is exceptionally still covered with the epithelium of the follicle (*aw*); (this is doubtless pathological); here, also, the end of the medulla has undergone a vesicle-like dilatation. *B* III. represents an extracted hollow root, a portion of which has remained upon the papilla; this shows the irregular, tooth-like end, traversed by the medullary canal. The cuticle is here everted, and was drawn while the axis of the hair was in focus. The best method for these examinations of roots is cleaning them up with commercial peroxide of hydrogen.

*New-Formation of Hair-follicles in the Adult.*—The disputed question as to whether entirely new hair-follicles are still developed in the adult is by no means yet settled. Götte and Hosse have pronounced themselves in favor of this origin of new hairs from the surface as a starting-point, after the fœtal pattern. No positive proof of this, by a continuous developmental chain, has, however, as yet been brought forward for any part of the body, and when we reflect that in the hairy surfaces of the adult the middle follicular region is everywhere the favored point from which under normal conditions many processes are sent downwards into the old follicle, or laterally into the corium; this part of the prickle-layer seems to have undertaken the rôle which the general surface plays in the embryo. This view is also supported by the insular arrangement of the hairs of the head which stand closest together, which still obtains. When the secondary hairs, from two to four in number, have arranged themselves around the primary embryonic hair, a circle of hair is formed from them during the growth of the skin which is separated from the nearest circle by a wide interspace. If the members of a circle of hair are very close together, the funnels of the follicles may become partially united, so that several hairs may come out of one large opening. We possess, however, a certain means of ascertaining whether these hairs were implanted independently near each other, or are post-embryonic descendants of one hair. The former is the case if the hair-follicles are fused together about the sebaceous glands, the latter, if the junction has taken place below them, owing to the fact that the hair-bed, from which alone they are developed, lies below the sebaceous gland. I have seen such certain descendants of hairs several times in the beard and four times in the eyelashes.

*Fall of the Hair.*—The different varieties of the fall of the hair can be referred to one of two principal forms. The first consists in the gradual atrophy of the newly-sent-out epithelial processes (this we have already considered) which are the less able to penetrate into the collapsed follicle the denser the corium becomes with advancing age. Such processes produce thin papillary hairs seated superficially, which are succeeded by correspondingly thin bed-hairs. The frequent repetition of this process leads to a condition in which the majority or all of the bed-hairs have assumed the lanugo form, and finally remain permanently in the bed-hair stage. The other form appears when the senile changes of the skin no longer permit the follicles to collapse; they then become filled with epithelial detritus, before the hairs have returned to the lanugo form. In the places from which the corium has disappeared along the hairs, one can always still recognize the cords passing vertically through them, which originally formed the external sheath of hairs.

*Sebaceous Glands.*—Under the name of *sebaceous glands* are comprised different kinds of acinous glands the secretion of which is consistent, fatty, and in part still inclosed in cells. The principal portion of them consists of the sebaceous glands proper, which develop in the prickle-layer of the hair-follicles. But with them are usually

classed different kinds of glands entirely independent of the hairs, a brief enumeration of which may well be made in this place.

*Meibomian Glands. Tysonian Glands. Glands of the Labia Minora and the Free Border of the Lips.*—The most important are the large Meibomian glands, which are embedded in the skin of the eyelids vertically to their free borders. They develop from the epidermis which unites the lids, and grow into the tarsus, in the form of long ducts lined with all three layers of the epidermis, and provided with acini bearing a perpendicular rounded cubical epithelium. The secretion of these glands is a mixture of sebaceous matter and epidermis. In this class the few Tysonian glands of the glans penis and prepuce also belong, to which was formerly erroneously ascribed the production of the smegma præputii, which consists almost entirely of horny layer, while the epithelial depression between the glans and prepuce of the clitoris, which also produces smegma, has no similar glandular indentations (Köllicker). Next come the large sebaceous glands of the labia minora, and, finally, the sebaceous glands of the free borders of the lips (Kölliker). All these glands might be comprised under the term "sebaceous glands of the mucous orifices."

*True Sebaceous Glands.*—The true sebaceous glands are, however, those which are embryologically connected with hairs, even if they afterwards lose this connection. Such are the sebaceous glands of the inner sides of the labia majora, the large ones of the nose and the external ear, those of the nipple and areola in man, and the caruncula lachrymalis, which belongs to the skin (Waldeyer).

The true sebaceous glands are very early developed in the prickle-layer of the embryonic hair as small lateral swellings, which are always seated above the dilatation of the middle follicular region and which first project on the side of the obtuse angle of the hair. Even before the first indication of an axial hair-cone is present, there occurs a fatty degeneration of the cells in the centre of the swellings from which the sebaceous glands are developed (Schulin). On staining with picro-carmin the contents of the sebaceous glands at once turn yellow, and they can, therefore, never escape recognition in specimens thus treated. The sebaceous gland gradually attains its definitive size by the enlargement of the primary swelling, its budding, and the formation of similar ones at the same level of the hair-follicle. It always forms the boundary between the funnel of the follicle, which is filled with normal epidermis, and the middle region, from two to six of them being attached to each hair. The minute structure of the sebaceous glands is the simplest imaginable. Upon a very thin membrana propria there is seated a cubical epithelium in a varying number of layers, often only one, which towards the centre of each acinus undergoes slow fatty degeneration, only the periphery of each cell escaping. In this way is produced a secretion of epidermic cells containing fat, the membranes of which gradually rupture, their contents being partially expelled in the form of small and large drops of fat. This secretion passes through the short excretory duct into the bottom of the funnel of the follicle, so that the hair passing through it is well lubricated. This is the true function of the sebaceous glands, which might better be called "the glands of the hair-follicles."

The fatty degeneration inside the gland frequently takes place unsymmetrically, extending on one side as far down as the basal cells upon the membrana propria. This always occurs on the side nearest the large blood-vessels, which is usually the lower one. In consequence of this the glands of the hair-follicles, when well stained, assume a peculiar unsymmetrical appearance. On the nose, the nipple of the male, and the other points already mentioned, the sebaceous glands attain considerable dimensions (being sometimes as much as two mm. in diameter) and then they sometimes have even as many as twenty acini (W. Krause). It may be stated that the tissue changes and chemical processes in the sebaceous glands, next to those of the small glands of the mucous mem-

branes, are the simplest and least active of all known glands. They consist solely in the fatty degeneration of ordinary epidermic epithelial cells.

*Coil-Glands.*[1] *Development.*—By far the largest mass of glands which the corium contains, is found in the shape of globular or oval coils in the subcutaneous tissue or embedded in the deepest layer of the corium proper. They make their appearance in the fifth fœtal month, first on the palms of the hands and soles of the feet, in the form of epithelial processes standing very close together and growing in a conical shape into the corium. Their situation relative to the ridges of the first-formed papillary layer is a very definite one. We have already seen that at first elevated ridges of connective tissue are separated from each other at regular intervals by epithelial processes, and that the papillæ are developed upon the tops of the ridges, the epithelium here also penetrating downwards. Between two rows of papillæ which have thus been separated from each other, the epidermis now penetrates still further at tolerably regular intervals, and in the course of the sixth month forms long thin cones which traverse the entire thickness of the corium, and assume a slightly bulbous shape at their lower extremities. Just above this blind end there is suddenly developed in the seventh month, the first trace of a lumen which extends rapidly towards the epidermis, after reaching which an opening is formed (from within outwards), *the sweat-pore*. At the same rate at which this lumen is developed, the subsequent cuticula also makes its appearances. At this time the lower end of the gland has usually already assumed a hooked shape, and the coil is now developed by an irregular rolling-up, the gland meanwhile steadily increasing in size. In contrast to the glands of the hair-follicles, the development of the coil-glands has, near the end of fœtal life, reached a point beyond which it does not afterwards go.

*Large and Small Coil-Glands.*—Another step in the development of the coil-glands, which, however, still goes on after birth, is their continued growth in certain parts of the body to larger varieties which present important structural differences from the ordinary small glands. These large ones occur in the axillæ and folds of the groins, around the anus and in the areola of the nipples, and in the external auditory canal. In the axilla, large and small glands are irregularly scattered through the layers of the skin, the large ones being confined to the hairy portions. In the groin, the small glands are seated superficially, the large ones deep down in the subcutaneous cellular tissue.

The circumanal glands form a single row, 1¼ to 1½ cm. from the anus (Gay). On the mammary areola also, which contains only large glands, they form a closed circle near its outer edge. The coil-glands of the auditory canal, which secrete the cerumen, lie in the cartilaginous portion as an almost continuous layer, mainly on the upper and under surfaces. Finally, the glands of Moll in the eyelids must also be classified with these varieties of coil-glands. They are really only broad convoluted tubes without coils, lined with large cylindrical epithelial cells, and provided with strong muscles, which empty with diminished calibre into the follicles of the ciliæ. Waldeyer has demonstrated transitional forms between these "modified coil-glands" and the ordinary variety, in the caruncula lachrymalis.

*Histology of the Small Glands.*—Histologically, the smaller glands present tolerably uniform appearances. The coil bears a simple cubical epithelium which is cloudy in its external portion, where it shows a striation radiating towards the centre of the canal (Ranvier). Internally it is provided with a clear border, which, according to the same

[1] The author substitutes the name "Knäueldrüse" for the familiar term "Schweissdrüse" (sweat-gland). Where the former, which I have translated "coil-gland," is used, the sweat-gland is always meant. (Translator's note.)

observer, may be thrown off, and in fact viscid, clear protoplasmic débris is found in the secretion of the glands. Upon these secreting cells are seated, externally, muscular fibres which run parallel with or spirally around the canal. I find (agreeing with Sappey, Heynold, Hörschelmann, and Ranvier, but in opposition to Leydig and W. Krause) that the muscular fibres are in direct contact with the epithelium, and that they both together are surrounded by a distinct membrane of connective tissue, a so-called membrana propria. Fig. 14, taken from the coil-glands of the palm of the hand, shows the muscular fibres in cross-section passing in between the epithelial cells, and in an oblique section running parallel to the canal at certain distances from one another. This very figure also shows, however, that the canal of the coil, just before it passes into the excretory duct, sometimes bears not a cylindrical, but a cubical epithelium, arranged in layers. The cells are, moreover, not completely cemented together, the cavity of the canal penetrating between them in many places, as far as the membrana propria. According to Ranvier, the muscular cells are formed from the ectoderm, an inner layer of epithelial cells being transformed into the secreting glandular cells, an outer into muscle cells.

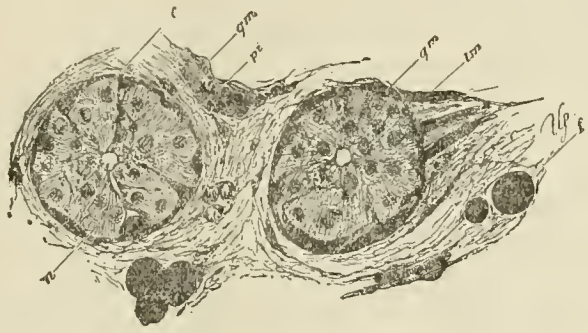

FIG. 14.—Cross-section through the point at which the coil passes into the duct of a coil-gland. *q m*, muscle in cross-section; *l m*, muscle in longitudinal section; *e*, epithelium of the coil; *n*, nerves of the coil; *f*, fat-cells; *p i*, pigment.

The *duct* is composed of an ordinary cubical pavement epithelium, arranged in two rows, the inner of which bears a cuticle which was discovered by Heynold. Outside of this epithelium is a thick layer of connective tissue, which borders on it by a membrana propria and has no muscular fibres. The epithelium of the coil has a clear border, which is not always blackened by osmium, whereas the epithelium lining the duct has a border which is always stained by it, probably in consequence of its imbibition of the excreted fats and fatty acids.

The duct runs more or less spirally through the corium, and loses, at its junction with the epithelium of the surface, its connective-tissue sheath externally and its cuticular border internally, so that for a short distance in the prickle-layer the strongly convoluted lumen is surrounded only by ordinary prickle-cells. But immediately beyond this part of the duct, well-developed granular cells draw near its lumen, much earlier than in other portions of the prickle-layer; then basal, next superbasal horny cells, etc. (see Fig. 3), so that one may say that all the layers of the epidermis sink down, in the shape of a funnel, into those next below them, to form the wall of the canal. At the point at which the wall of the canal is composed of basal horny cells, it shows a decided slit-like contraction.

*Sweat-pore.*—It follows from the relation of the duct to the epidermis that it really terminates in the basal prickle-layer, and that the corkscrew-like spiral canal in the

epidermis which seems to be its direct continuation, does not belong to it alone, but also to the open juice-spaces of the epidermis which surround it. It is, therefore, proper to sharply distinguish this portion of the canal under the old name, *sweat-pore*, from the rest of the duct of the coil-gland, in view of the fact that the fluids which pass upwards in them are not identical. The sweat makes its appearance externally at the sweat-pore, but we have no right to maintain that it comes from the duct (at least entirely) and eventually from the coil. This is also the reason why we have wholly ignored the misleading name, *sweat-glands*, and have reintroduced the older and better term, *coil-glands* (*Meissner*).

*Histology of the Large Coil-Glands.*—The large glands are distinguished from the small ones, aside from their often great thickness and length, mainly by the fact that they present irregular dilatations and constrictions. As a rule, the widened portions with a large lumen are lined with one layer of cylindrical epithelium and also have bundles of muscular fibres externally, even if they already constitute a part of the duct, as is often the case in the axillary glands; the narrower parts of the duct between them are again lined by several layers of pavement epithelium without muscles. The duct and the coil in the large coil-gland, therefore, cannot morphologically (nor, perhaps, physiologically) be so simply separated from each other as in the small glands.

*Secretion of the Coil-Glands.*—The secretion of the coils is composed in part of albuminoid, viscid cellular débris with nuclei, containing drops of fat and pigment granules. In the small glands it is almost always clear and transparent, except in old age, when much pigment is also found in it. The secretion of the large glands is often also clear, but is usually darker, containing fat and pigment. A great many mixtures intermediate between these two extremes are also met with. To regard the secretion of the coils as a simple watery fluid is entirely unwarranted, and we must admit, from an anatomical standpoint, that the different coil-glands of the human skin, from the smallest on the trunk to the larger ones on the palms and soles, those around the anus, etc., appear like links in a complete chain of development. The distribution of the coil-glands over the surface shows that the flexor aspects of the trunk and the extremities have the preference over the extensor, and that the larger collections of coil-glands are confined to the surfaces of contact of the joints, and the mammary and anal regions. In man, as in the animal, the higher development of this glandular apparatus is associated with the surfaces of contact in the broadest sense which most require lubrication; we also recognize the periodical presence of fat in all the coil-glands, and its constant presence in the larger ones, and, finally, during fœtal life, when the body has most need of lubrication, we find the same apparatus at the highest point of its development and activity. On the other hand, no one would seriously speak of the sweating of the fœtus.

*Function of the Coil-Glands.*—We must return to the view advocated in 1856 by Meissner, that the whole apparatus of the coil-glands is destined *solely for the oiling of the body*. That it is, on the whole, better adapted to this purpose than the glands of the hair-follicles is clear from the standpoint of anatomy: according to the older Krause, there are more than two million (according to recent estimates still more) coil-glands tolerably uniformly distributed over the body (with a preference for the surfaces of contact). On the other hand (according to W. Krause), there are only about one hundred thousand hair-follicles with sebaceous glands, of which about eighty thousand are crowded together upon the hairy scalp alone. Finally, no sebaceous glands are found on the palms of the hands and soles of the feet, which certainly require lubrication and are never without it. The secretion of the sebaceous glands, the greater part of which is still inclosed in cells, is deposited directly upon the cornified surface of the funnel of the hair-follicle, whereas the secretion of the coil-glands is placed at the disposal of the lower layers of the epidermis. There is much more warrant for ascribing a lubrication of the surface to the

"sebaceous glands of the mucous orifices" than for the view generally held as to the function of the glands of the hair-follicles. These acinous glands would then also physiologically occupy a place midway between the glands of the hair-follicles and the coil-glands.

*Function of the Sweat-Pores.*—It would hardly seem possible, therefore, that the sweat has hitherto been believed to come from the coil-glands, if it were not for the fact that sweat-pores are direct continuations of these glands. But now that we know that the intercellular passages of the epidermic cells open into the sweat-pores and furnish a means of escape externally for the tissue-fluid of the epidermis, this circumstance has lost all its value as a proof. Just as we cannot ascribe the formation of all the ingredients of the urine to the Malphigian bodies alone, just so surely is the sweat only in small part the production of the coil-glands. *The sweat-pores are the conditio sine qua non of sweating.* The dog does not sweat because he has no sweat-pores, although he has coil-glands which open into the hair-follicles.

*Coil-Glands and Subcutaneous Cushion of Fat.*—While we must, therefore, ascribe the work of lubricating the epidermis only in very small part to the sebaceous glands, and by far the largest to the coil-glands, we also assign to the latter the formation of the subcutaneous cushion of fat. The anatomical relation between these two becomes evident even during fœtal life. They appear simultaneously, in the fifth month, first on the palms and soles, and progress at the same rate in their development. At birth the panniculus is so highly developed that (allowance being made for extent of surface and bodily weight) it is about five times as thick as the subcutaneous fat of a stout adult. The fat is comparatively firm, of a grayish-white color, crumbles readily, and when cut into allows no oil drops to escape (Langer). At the same period the coil-glands occupy a relatively large part of the skin (see Fig. 1). Their product, which we find in the vernix caseosa mixed with epidermis, is firmer and contains more stearin than in the adult. After birth, the coil-glands and clusters of fat begin to concentrate at certain points, and we there find the connection between the two reproduced, collections of fat being found even in the thinnest individuals at the points provided with large coil-glands, and a typical cushion of fat is always present in those parts which have the most coil-glands (palms, soles, hairy scalp). The fatty secretion of the coil-glands and the fat of the subcutaneous tissue both change at the same time their chemical constitution, appearance, and consistence. Both kinds of fat become softer and more oily, and the stearin diminishes as compared with the palmitin and the greatly preponderating oleïn.

Topographically, however, the relation between the two structures can be followed still further. The majority of the coil-glands penetrate into the subcutaneous stratum, or they remain in the larger fissures of the corium. In the former case, their form becomes round and regular, and they become gradually closely surrounded by fat-tissue; the coils which remain in the corium assume flatter and more angular shapes, are not surrounded by fat-tissue, *but the latter regularly advances towards them in columns.* The prolongations of the subcutaneous fat into the corium always run towards single coil-glands or towards several united in a group. Those coil-glands which seem to have no connection with the fat-tissue, as is often the case in lean individuals, always present scattered between their loops at least a few heaps of fat-cells. A small but a very typical portion of these cutaneous columns of fat which pass upwards at the site of the hair-follicles (see Fig. 1) has recently been described by J. Collis Warren under the name of columnæ adiposæ, but their connection with the coil-glands has entirely escaped this author.

*Fat-tissue.*—With Flemming, we distinguish in the subcutaneous fat of the adult, which is developed by a process of partial atrophy from that of the new-born child, three kinds of collections of fat, which may be described according to their relations to the vascular system of the skin. The "true fat-lobules" are supplied by large blood-vessels of their own, which break up in them to form a close capillary network surrounding the individual fat-cells. Flemming applies the term "fat-columns" to those masses which lie along the larger vascular branches of the subcutaneous tissue and are but scantily supplied with capillaries. "Fat-islands," finally, are entirely isolated small groups of fat-cells without blood-vessels of their own; they occur but seldom in the human subject.

*Histology of the Fat-tissue.*—The fat-cells are developed from ordinary, flat branching connective-tissue cells, some of which take up fat in fine drops. While these drops increase in number and become confluent, the protoplasm of the cells also grows, and the cells assume a rounded shape. These young fat-cells are now changed, by the continually enlarging drops of fat, into large globular bodies; the protoplasm containing the nucleus is pushed to the periphery, and thus gradually assumes the appearance of a membrane. A real membrane is not an essential attribute of the fat-cell; only in old fat-cells does the protoplasm sometimes become condensed into a membrane-like covering.

The globular drop of fat of the mature fat-cell presents certain peculiarities which render it probable that it consists of a mixture of fat with other products of the disintegration of protoplasm. Thus, when stained with picro-carmin, it often assumes at certain points a pale red color, and also presents more deeply stained red granules at such places. Here are also most frequently found those fatty crystals which probably are formed during the cooling of the skin after death. The drop of fat frequently contains vacuoles with thin-fluid contents.

The mature fat-cell may persist in this form for any length of time without undergoing any visible alteration. But a real permanence of its component parts is not probable, particularly as the fat-tissue is extraordinarily rich in blood-vessels. It is therefore probable that a constant transformation and reproduction of the fat takes place. If the former predominate over the latter, the various forms of atrophy result.

In the human subject, "serous atrophy" is most frequently met with, characterized by the disappearance of the drop of fat alone, the cavity thus left in the interior of the cell being filled with a serous fluid, and the fat-cell thus at first retains its original size. If the atrophy progress, the fat-cell diminishes in bulk and finally becomes reduced to a mass of protoplasm, lying in the interior original cell near the globule of fat, and surrounding the nucleus. During these processes, the connective-tissue cells between the fat-cells become filled with very minute drops of fat, and it is possible (?) that free finely-divided fat is also deposited between them. A constant phenomenon during the course of the atrophy is the appearance in the fat-cells, and adjacent connective-tissue cells, of "*secondary drops*," which grow in the fat-cells as the primary drop disappears, usually differing from it in consistence and color. They are therefore certainly not produced by its disintegration, but are the result of a secondary new-formation. Much more rarely are the two other varieties of atrophy met with: "*simple atrophy*," in which the protoplasm diminishes concentrically with the fat-globule; and "*atrophy with growth*," in which multiplication of nuclei and cell-growth coincide with the atrophic process. Instead of the cell being reduced to the status of the connective-tissue cell, it may either entirely disappear (as in the skin of old people) or groups of daughter-cells with fibrillary

connective tissue may be formed. The disappearance of the fat is ultimately followed by atrophy of the surrounding capillary network.

Besides the blood-vessels and very scanty fibrillary connective tissue, only ordinary connective-tissue cells are found between the fat-cells within the large lobules, in inverse proportion to the quantity of fat-cells already present, because they themselves become fat-cells if the layer of fat increase in thickness. The fat-tissue, like the larger and firmer connective-tissue columns of the subcutaneous tissue, contains a large number of holes and juice-spaces, but is entirely destitute of lymph-channels with independent walls.

We have considered the fat-tissue in connection with the coil-glands, for the reason that it is only a dependent of the latter, a portion of the corium which, owing to the activity of these glands, has undergone a peculiar transformation. Despite its early appearance in fœtal life, the fat-tissue does not belong to the typical constituents of the skin, since skin in most parts of the body may be well developed, yet without a cushion of fat, under physiological conditions.

*The Coil-Glands produce the Fat-Cushion.*—We have already seen that the products of the coil-glands consist of fat and other things (fat-formers, fatty acids, soaps). These are all steadily pushed onwards towards the epidermis by the action of the smooth muscular fibres of the coil-glands. As is well known, the muscles alternate quite regularly with the epithelium, so that the entire secreting epithelium comes directly in contact by half its surface with the lymph-spaces around the coils which extend into the connective-tissue sheath of the latter. The muscles are, therefore, really destined to further an exchange and reflux between the secreting epithelial cells and the lymph which flows around them. In this they are aided by the above-mentioned arrangement of the oblique muscles of the skin, which exert an expulsive influence only upon the contents of the duct, and a retarding one upon the glandular products in the interior of the gland, as upon its circulation. This arrangement seems a highly practical one, because heat, which relaxes the vessels, calls forth, by causing a hyperæmia of the whole papillary layer, a profuse watery alkaline sweat, and at the same time, by relaxing the oblique muscles of the skin, opens wide the way for the passage of the fatty products of the coil-glands to the surface, thus counteracting the unpleasant effects of the alkaline tissue-fluids upon the epidermis by means of the acid and fatty products of the glands. On the other hand, every increase in the tension of the framework of the skin by its oblique muscles, must lead to a retention of the secretion of the coils, and thus facilitate the passage of the products from the naked coils into the surrounding lymph-spaces.

We must at any rate imagine the lymph which streams away from the coils to be loaded with fatty products. This lymph has, however, no lymphatic vessels of its own, but is taken up in part by the few lymphatic vessels coming from the corium, but mainly by the cutaneous venous trunks. The lymph, while being thus taken up, must, of course, be filtered in such a way that its fatty elements are left behind in the subcutaneous tissue and accumulate there. By this process, I explain the storing-up of fat by the cells of the subcutaneous tissue and their conversion into fat-cells.

The first collection of fatty lymph, in the embryo as in the adult, exercises an irritating influence and attracts capillaries from the nearest blood-vessels, whose venous branches take up all the lymph except its fatty portions, the arterial furnishing the oxygen used in the elaboration of the fat. The lymph-corpuscles which, as usual, become separated from the current of blood, collect around the fat-lobules. The fact of their accumulation when fat-tissue is first formed, cannot, however, be utilized to explain the

origin of the fat-tissue, in view of the absence of any transitional forms between wandering and fat-cells. In places where the budding of the sanguineous capillaries is less abundant, the fat which has been filtered out at first remains behind on all the larger venous branches and their attendant lymphatic vessels, around which the "fat-columns" are then formed, which so often accompany these vascular tracts. Between the coil-glands and the fat-layer proper, fat-islands, fat-columns, and single clusters of fat mark the course of the fat-laden lymph. If the latter become exhausted, atrophy of the fat-lobules (Flemming) begins, *externally* of course, and thence progresses concentrically inwards, towards the absorbing blood-vessels. In this way the association of coil-glands with fat-tissue is fully explained.

It still remains to cast a brief glance at the vascular and nervous trunks which grow from within outwards into the corium.

*Blood-Vessels.*—Tomsa has shown that both the size and form of the individual vascular trunks which supply the different portions of the corium with blood, are subject to great variations. On the extensor surfaces of the extremities and trunk, the territories supplied by single arteries are much larger than on the flexor surfaces; the vascular trunks are most numerous in the palms of the hands, the soles of the feet, and the face. Their form is dependent upon the local cleavage. While in parts of the skin where the cleavage is not uniform, the vascular trunks are very tortuous, and run almost vertically upwards, and the area of distribution of their very crooked branches is of a rounded shape, in parts with uniform cleavage they are crowded together, by the bundles of fibres tightly stretched in one direction, into flat *circulatory planes*. According to Tomsa, the best way to find such a circulatory plane is to make *oblique sections* through the corium, *parallel to the hair-follicles*, and therefore at right angles to the direction of cleavage. Fig. 1, however, shows that the horizontal ramifications may be completely exposed by a section made *vertically* and at the same time parallel to the direction of cleavage and of the hairs. Between the horizontal, oblique, or vertical planes of circulation there are, of course, some parts of the corium which are relatively poor in vessels.

The horizontal distribution of the vessels which in part run obliquely, in part vertically upwards occurs principally in two regions of the skin—at the border between the corium and the subcutaneous tissue, and at that between the former and the papillary layer.

*Papillary Circulation.*—Underneath the papillary layer we find a wide-meshed arterial network, composed of narrow tubes, the longitudinal axes of which run in the direction of the grooves of the epidermis. This network sends upward a tortuous arterial capillary to each vascular papilla, which bends over in the shape of a loop to form the still more tortuous venous capillary. All the venous capillaries of the papillary layer again unite to form a close, narrow-meshed venous capillary network at the same level as that in which the arterial lies, and from this larger veins arise, which run through the corium in the same direction as the arteries.

All the vessels of this papillary vascular system and the larger branches in the corium connected with them consist only of an endothelial tube, which is joined, near the subcutaneous tissue, by a very insignificant media and adventitia. They are therefore mainly of a capillary nature. The arteries are narrow, the veins comparatively very wide.

In three places, the papillary vessels present dilatations in the deeper portions of the corium. In the first place, they furnish the flat vascular networks of the hair-follicles which lie between their middle and external sheaths and the basket-like plexuses

of the sebaceous glands. The oblique muscles of the skin also receive their vascular supply from this source, and a third branch-plexus accompanies the excretory ducts of the coil-glands downwards. Minor deviations are found in some parts of the skin. Thus in very short papillæ the ascending papillary loops are often entirely wanting, giving place to irregular plexuses; on the external ear, the alæ nasi, and around the lips, the whole subpapillary vascular net is transformed into a series of large lacunæ, into which the venous capillaries empty from above, and the veins from below (Tomsa).

*Circulation of the Coil-Glands and Fat-Tissue.*—Below the papillary system is a horizontal area poorly supplied with vessels, which is the broader the thicker the corium; the fibrous bundles of the corium themselves have no capillaries. An exceedingly abundant distribution of vessels is found at the border of the subcutaneous tissue. In the first place, independent branches are here given off by the small arterial trunks, to furnish a capillary loop for each hair-papilla. All the coils of the coil-glands also receive capillary plexuses from this source. If the coils lie close together, a common plexus is formed by their vessels. Finally, the vessels which form dense networks of capillaries inside the fat-lobules take their origin from this point. The vessels of the individual lobules also unite, when the fat is abundant, to form horizontal nets, this usually taking place simultaneously with a corresponding occurrence in the coil-glands. In this way, a vascular plexus is formed at the lower border of the corium also, which occupies a much larger extent of surface than that of the papillary layer.

We may regard the *horizontal* distribution of the vascular trunks as taking place mainly at the two borders of the corium, and may divide it into the *papillary system* (with ascending loops for the papillæ and three kinds of branches in the lower portions of the corium) and the *system of the coil-glands and fat-tissue* (the vessels running upwards to the former, and downwards to the latter).

The horizontal form of the distribution of the vessels in the adult is due mainly to the increase in thickness of the corium. In the fœtus and new-born child, the obliquely or vertically ascending vessels give off branches irregularly to the nearest epithelial structures. Only after the deposition between them of firm bundles of fibrillæ, are the horizontal terminal branches near the border of the papillary layer crowded together to form a network, and with the descent of nearly all the coil-glands to the lower border of the corium, and the gradual atrophy of the subcutaneous fat, the vascular territories of the coil-glands and the fat-tissue unite to form the broad subcutaneous plexus. The larger vessels of this plexus gradually assume after birth, by the addition of a media and a thick adventitia, the characters of arteries and veins, while the vessels above them retain their indefinite embryonic (capillary) character. When in adult life the subcutaneous fat again attains considerable dimensions, the upper portion of the fat-cushion is supplied by the cutaneous, the lower by the musculo-fascial vessels.

*Direct Passage of the Arteries into the Veins of the Skin.*—A peculiar arrangement of vessels is found in the skin of the terminal phalanges of the fingers and toes. Hoyer describes it as of a double nature in man. In the first place, branches of the digital arteries empty directly into the wide veins of the nail-bed, and in the second place, after giving off branches for the fat and coil-glands of the skin of the finger, but before the papillary system is formed, empty into numerous small vascular coils, inside which they also pass into veins. Under ordinary circumstances, these direct transitions evidently serve as regulators for the obstructed capillary circulation through the ends of the fingers and toes, in which, aside from their unfavorable situation, the absence of the muscular, and the insufficient development of the elastic elements of the corium come into play.

If we take a general view of the circulation in the skin, we are forced to admit that there is no such thing as a functional division of it into a circulation for respiration, secretion, muscular movements, etc. Its distribution is uniform from the first, and becomes transformed into a double one only by mechanical influences. This latter fact is of great importance, because by it alone many pathological processes in the skin remain confined to the fibrillary circulation and its annexes. The unusual thinness of the walls of the cutaneous and subpapillary vessels is doubtless a consequence of their being embedded in firm papillary tissue; the skin-veins which rest upon a very firm basis even assume the form of blood-sinuses with extremely thin walls. The absence of highly-developed muscles upon the vessels of the skin is in part compensated by the elastic frame-work, which is influenced by the external temperature through the oblique tensors of the skin. The very distensible capillary loops of the papillæ probably possess the power of independent contraction under nervous irritation.

*Lymphatic Vessels.*—The absorbent lymphatic apparatus of the skin is an unsymmetrical secondary appendage of the vascular circulation with a centripetal direction; it has one peculiarity, however, viz., that large masses of tissue, absolutely devoid of blood-vessels, are embedded in it, *i. e.*, the epidermis and its appendages. Recent investigations have defined with satisfactory clearness the exact course of the lymphatic channels of the skin, but as the statements of authors are often absolutely contradictory, it behooves us to ascertain the real truth of the matter.

It is certain that all parts of the skin contain juice-spaces; on this point there can be no difference of opinion. As the nomenclature of pure unapplied anatomy is insufficient for our purpose, we shall designate as *juice-spaces all those lymphatic channels which do not possess an absolutely free outflow into well-marked lymphatic vessels lined with endothelium, whether they are devoid, as is usually the case, of independent walls or are provided with them; lymphatic vessels, on the other hand, are those channels from which a free outflow into the blood takes place.* Let us now consider from this standpoint the system of juice-spaces of the skin.

*Juice-spaces of the epidermis.*—The juice-spaces of the epidermis are represented by the interspinal passages of the prickle-cells. These will be most readily understood by imagining a low hall, the roof of which is supported by innumerable columns standing close together. Since Axel Key and Retzius have succeeded in injecting these spaces from the lymph spaces of subcutaneous tissue, it is certain that they are already formed lymphatic passages. I also once observed a natural infiltration of these channels with fat, in which the fat, stained by osmium, surrounded the cells with a black frame (see Fig. 15). But it is another question whether the interspinal passages do not also contain a soft, viscid substance, somewhat analogous to the so-called cement substance of the endothelium.

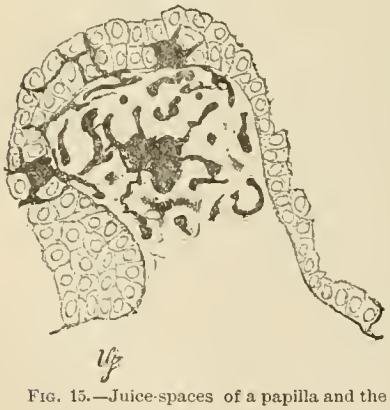

FIG. 15.—Juice-spaces of a papilla and the adjacent epidermis with a natural fat-injection.

That the prickle-cells require no cement to hold them together is clear from the description of their connecting threads.

The question is simply whether or not a more consistent substance is found in them. Such seems to be the case. In treating sections of the epidermis with alkalies, it sometimes happens

that the prickles are bent and broken by the expansion of some interspinal substance, and sometimes injections of the epidermis with chloroform-asphalt fail completely, and they very rarely succeed entirely, although the interspinal spaces are well-developed. These injections would always succeed if some obstruction were not encountered in the majority of cases.

FIG. 16.—Lymph-passages of three papillæ, injected with asphalt.

It is a priori a necessity that the lymph which flows from them should carry off the products of tissue-changes in the prickle-cells; it is possible that there may be among them a readily coagulating substance, capable of obstructing the passages. But even if we assume that the interspinal passages are partially filled with a soft viscid substance, the nutrition of the epidermis would not even then represent a simple process of imbibition, for the interspinal passages are also traversed by fine nerve filaments which often have a capillary cavity around them, and they both, nerve and perineural cavity, always pass through the protoplasm of the cells and terminate in the nuclei.

Even where an interspinal substance is wanting, we always find deposits of lymph in the fresh skin.

The most beautiful specimens are obtained from slightly œdematous skin, treated for

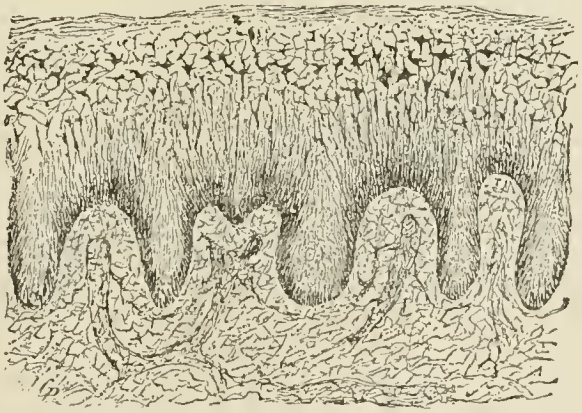

FIG. 17.—Staining with gold of all the lymphatic channels of the papillary layer and epidermis of a slightly œdematous skin.

a short time with the boiled mixture recently recommended by Ranvier, four parts of chloride of gold and one part of formic acid. In specimens thus treated, we see very distinctly, according to the heaviness of the deposits of gold, those passages which are preferred by the current, and those in which stagnation occurs. Fig. 17 shows such a picture from an œdematous prepuce. At the apex of the papilla, a thread of gold corresponds to each

intercellular space, and consequently the threads radiate like a tuft of hair from the surface of the corium. In the upper horizontal layers these threads divide, corresponding to the contours of the cells, anastomose, and then present between the granular cells rows of forked ends, from which rows of granules may be followed some distance further, as the last juice-spaces between the horny cells. Below the granular layer we see nearly all the juice-spaces filled with star-shaped wandering cells, which send their branches in part upwards, in part downwards between the cells, while they are otherwise plentifully but still less numerously distributed in the prickle-layer; they are unable to creep into the narrow spaces between the granular cells and therefore stick fast all through this layer. In contrast to the tops of the papillæ the streams of lymph at their bases and in the interpapillary prickle-layer are few in number. In these places only a finely granular deposit of gold is found between the cells. We must, therefore, regard the circulation of the juices as much less energetic in this interpapillary prickle-layer, or, in other words, the slow reflux of the lymph takes place at these points. This conclusion may also be reached from another circumstance. Key and Retzius found, as has already been mentioned, that the sweat-pores can be filled from the cutaneous lymph-passages by way of those of the epidermis. We therefore have in the sweat-pores a means of escape for the lymph circulating through the epidermis, and they are without exception situated in the interpapillary depressions.

*Direction of the Current of Lymph in the Epidermis.*—The lymph, therefore, flows to the epidermis mainly from the apices of the papillæ, thence spreads in all directions through the former and returns to the corium by way of the interpapillary depressions, through the sweat-pores of which it may, under some circumstances, be discharged externally also.

The papillæ are very uniformly traversed by juice spaces (see Fig. 16). They become confluent near the centre of the base of the papilla, at which point the beginning of a lymphatic vessel is usually found; this passes upwards in the axis of the papilla to a distance of two-thirds of its height.

The excretory ducts of the coil-glands, the sebaceous glands, the prickle-layer of the hair-follicle and the hair-bed, have the same interepithelial juice-spaces as the epidermis. In the last situation the ascent of pigment in them can often be recognized. The hair papilla, reasoning from analogy, is probably also traversed by lymph-spaces which communicate with the interepithelial spaces of the matrix of the cortex which contain pigment, and with those of the matrix of the medulla, cuticle and root-sheath, which are destitute of pigment, and extend in all directions as far as the horny portions of the hair. The oblique muscles of the skin and the coils of the coil-glands float in distended lymph-spaces, in which respect the latter differ from the sebaceous glands which are surrounded by a much smaller number of juice-spaces. In the case of the arrectores, these lakes of lymph furnish room for their movements, and in that of the coil-glands they supply material for the fabrication of their specific products. The connective-tissue bundles are all ensheathed by lymph-spaces of various forms; also the larger fat-lobules, from whose lymph-sheaths very slender lymph-canals extend between the individual fat-cells.

*Lymphatic Vessels.*—In contrast with this *infinitely complicated system of juice-spaces*, the skin has only a small number of real *lymphatic vessels*. This system of vessels begins in the upper third of the papillæ with blind extremities into which the juice-canals empty, as they do everywhere else, through holes (Schenk; pseudostomata: Klein) and through the porous cement ridges of the endothelia (stomata). The lymphatic vessels then unite to form a continuous plexus which uniformly permeates with its not

very narrow meshes the entire skin. The transverse and vertical connecting branches of this network increase steadily in width as they approach the subcutaneous border, and are scattered through the corium in such a manner that they keep as far from the blood-vessels as possible. Having reached the subcutaneous tissue, they collect into a few larger lymphatic vessels upon which Flemming demonstrated the rudiments of a muscular apparatus. These lymphatic vessels of the skin are relatively few in number. This fact, together with another, viz., that the veins of the skin are of extraordinary width as compared with its arteries, compels us to believe that the greater part of the lymph which circulates through the skin is taken up by the veins. Physiology has already declared in favor of this view, since œdema of the extremities cannot always be produced by tying all the lymphatic trunks, whereas it always follows ligation of the veins. But while the lymph of the papillary layer and of the epidermis with its appendages always has an assured free outflow into the cutaneous lymphatic vessels, the lymph which comes from the *vessels of the coil-glands and fat-tissue*, although provided with well-developed juice-spaces, has no way of free escape. The lymph which sluggishly flows off from these structures is filtered upon its entrance into the passing cutaneous veins and lymphatic vessels, and this filtration is, as we have seen, the starting-point of the formation of the subcutaneous fat. Lymphatic vessels, as we define them, are found neither in the fat-tissue nor in the subcutaneous tissue which is destitute of fat.

*Nerves.*—The sensitive twigs of the cerebral and spinal nerves penetrate from below into the skin in larger bundles and at much greater distances apart than the blood-vessels. They first run a longer course horizontally in the subcutaneous tissue, repeatedly breaking up into thin branches, and finally pass through the corium with the ascending vessels. In some parts, these nerves give off, inside the subcutaneous tissue, branches to the corpuscles of Vater (Pacinian). *Corpuscles of Vater.*—These are oval bodies, visible to the naked eye, the principal bulk of which consists of an enormous enlargement of the sheath of Schwann into concentric lamellæ, having nuclei and lined with endothelium. Between the middle layers of these lamellæ, which are everywhere interrupted by transverse septa, there is a large quantity of albuminous lymph by which they are irregularly distended. This thick capsule of connective tissue incloses a much narrower cylindrical cavity filled with a granular indistinctly fibrous substance containing cells and traversed in its centre by the sensitive nerve. This loses its medulla on entering the cavity, although it remains double contoured (Ranvier), and ends either singly or divided in the corpuscle, with one or more bulbous extremities, or passes entirely through it to terminate finally in a single filament in a second or a third Pacinian corpuscle. According to W. Krause, these bodies serve as instruments of touch, which enable us to appreciate pressure or traction by transforming them into hydrostatic pressure. They are especially numerous in the fingers, toes, palms and soles, etc.

After passing through the corium, the nerves again assume a horizontal direction at the lower border of the papillary layer, and here form a true nerve-plexus underneath the epidermis. According to some authors, nuclei or extremely small ganglion-cells are found in these nerves and in those which arise from this point, which are still medullated. The branches which pass still further upwards are in part very short, and break up below the epidermis into fine non-medullated fibrillæ which branch very freely, some branches terminating on the endothelia of the papillary vessels, while others can be found terminating with small bulbous extremities free in the connective tissue (probably these also end in large connective-tissue cell-plates). By far the larger number of them, however, penetrate between the epithelial cells into the interspinal spaces.

Others of the medullated branches are longer, pass upwards in the papillæ, and go towards the tactile corpuscles (of Meissner), which are here scattered throughout the entire skin. These bodies present, in contrast with the Pacinian corpuscles, a striking transverse striation. According to Ranvier, their development can be studied in the newborn child as follows: At the apices of some papilla a transverse striation is found, due

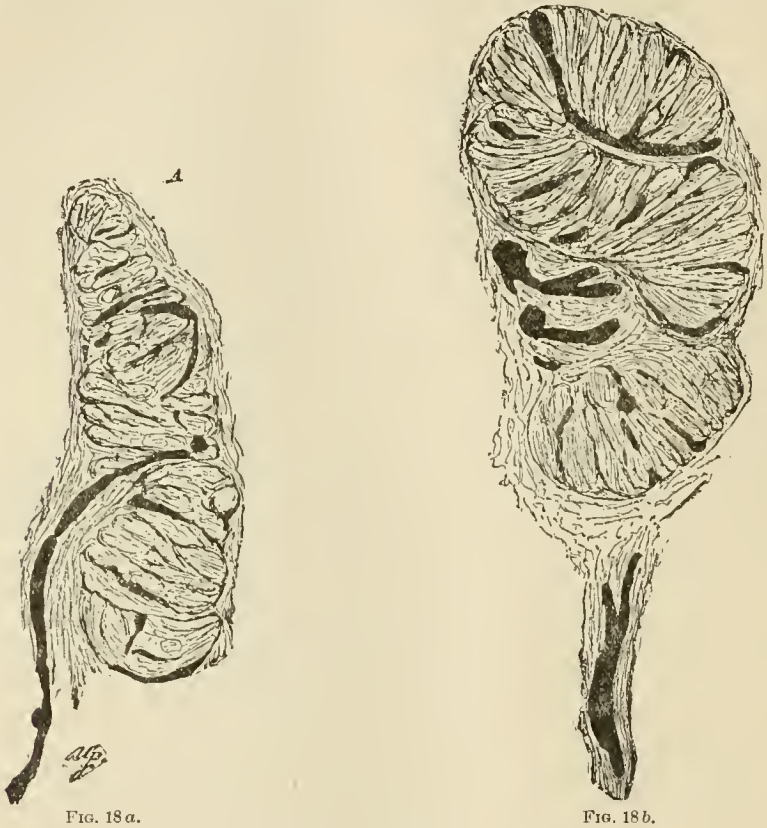

Fig. 18*a*. Fig. 18*b*.

Tactile Corpuscles.

to a horizontal bundle of fine terminal nerve-branches, and beneath it a little heap of cells of the mesoderm. While the nerve-branches are becoming larger and more numerous, this heap of cells pushes itself in between them, and in the sixth month forms one lobule of the tactile corpuscle. Beneath this is often found a second bushy branching bundle of nerves to which a new heap of cells applies itself from below. In the adult, therefore, we find tactile corpuscles with one, two, and three lobules, each supplied with a medullated nerve-branch. They seem closely pressed together, and consist of large flat connective-tissue cells, arranged like rolls of coin, with medullated nerve-fibres ramifying between them. The swollen lateral edges of the cells, which contain the nuclei, are alternately pressed against the outer border of the corpuscle, and this, together with the profile view of the medullated nerves which here and there run around the corpusle, gives the impression of a coarse transverse striation. The axis of the whole column of cells is usually vertical (see Fig. 18*a*), but is often variously bent, especially when greatly developed (see Fig. 18*b*). The final off-shoots from the nerves lose their medullary substance inside the corpuscles.

According to E. Fischer (Flemming), medullated spots alternate with non-medullated on the nerves which penetrate between the cells, and which after repeatedly dividing and subdividing, terminate finally in bulbous extremities (gold-specimens).

*Nerves of the Epidermis.*—The non-medullated branches of the sub-epidermic plexus ascend vertically between the cylindrical basal cells, and give off—after repeatedly dividing, and perhaps also uniting to form plexuses—fine terminal branches to all the prickle-cells as far as the granular-layer, which, coming from different nerves and various directions, enter each cell in pairs. They perforate the protoplasm of the cells, and apply themselves to the nucleus from without, terminating in minute bulbs. They often run half-way or entirely around the nucleus, but without penetrating it (see Figs. 19 and 5). Their typical manner of termination in the epidermis is, therefore, *a double, intracellular one*. Terminal bulbs are also found between the cells, but so irregularly and often in such numbers close together that it seems as if they had only lost their more advanced layers of epithelium. The non-medullated threads, which go to the capillary loops of the papillary layer behave exactly like these intra-epidermic nerves. They terminate in pairs, with bulbous extremities in the endothelial cells, in the vicinity of the nuclei.

*Nerves of the Hair-Follicle.*—I have also succeeded in demonstrating the terminations of the sensitive nerves in the prickle-layer of the hair-follicle; here also they end

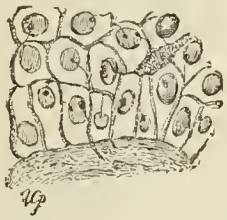

Fig. 19.—Termination of the Nerves in the Cells of the Epidermis.

inside the cells with two bulbs. The larger nerve-trunks may be everywhere followed as far as the constriction of the hair-follicle below the sebaceous glands. At this point, after passing through the follicle, they lose their medullary substance externally at the homogeneous membrane, which they perforate, and then give off filaments in the prickle-layer of the follicle. The hair-follicle is therefore supplied only from above.

*Nerves of the Coil-Glands.*—The ducts of the coil-glands also receive nerves from trunks which lie close to them just below the epidermis. According to Ranvier, tactile plates of the shape of an ivy-leaf are here met with, in which these nerves terminate, spreading themselves out on the corium. The nerves of the coils have been followed close up to them by Coyne and Herrmann, but these investigators failed to find their real terminations. Dr. Openchowsky (written communication) has followed, by the gold-method, non-medullated threads into the coils themselves. In good osmium preparations I have seen terminal nerve-bulbs in the secreting epithelial cells, as well as in the layers of transitional epithelium at the beginning of the duct (see Fig. 14), but I have not yet been able to form a positive opinion as to their constancy and double nature.

The statement of W. Krause, that all sensitive nerve-fibres finally terminate without medullary substance and in minute enlargements, therefore, seems justified. The larger part of these terminal bulbs is found in the epidermic cells themselves, as far up as the line of cornification. The peculiar tactile instruments, the corpuscles of Meissner and Vater, must, therefore, perform some special function, since they can no longer be regarded as instruments of general sensation.

*Pigment of the Skin.*—We conclude our study with an allusion to the pigment of the skin. Although of but little importance in the skin of the white race, we could associate it neither with the epidermis nor with the connective tissue alone, since it is formed in both germinal layers in a hitherto entirely unexplained manner, in the normal skin, mainly in the epidermis; in the pathological, principally in the corium. The physiological paradigm of the pathological pigments of the corium is found in the hair-change, in the connective-tissue cord of the old lower portion of the follicle, with atrophied and new-formed vessels. As far as I know, Waldeyer alone has demonstrated pigmented connective-tissue cells in the normal (?) corium of the eyelids. All the rest of the pigment of the European in the deeply-colored parts (scrotum, mammary areola), and over the whole body in the colored races, is found in the epidermis around the nuclei of the prickle-cells. In slight coloring, it is found only in the lowermost cells of the prickle-layer, and, therefore, the white color of the granular layer still asserts itself strongly. If the pigment ascends, as in the negro, as high up as the granular layer, the skin assumes a saturated dark color. The horny layer always remains free from granular pigment; at most, the horny membranes assume a darker horny-yellow color. As is well known, the colored races are unpigmented at birth, and a careful study of the manner and time of pigmentation on embryos and new-born children would doubtless throw more light on the relationship between different races than the futile attempts to utilize the hair and the coloring of adults for this purpose.

# PHYSIOLOGY

BY

H. VON ZIEMSSEN.

TRANSLATED BY CHARLES L. DANA, M.D.

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## THE RESPIRATORY FUNCTION OF THE SKIN.

A RESPIRATORY process, analogous to that of the lungs, takes place in every part of the skin. The excretion of water and carbonic acid gas through the skin is undoubted; but the excretion of nitrogen and the absorption of oxygen are doubtful. According to A. Gerlach, the lungs absorb one hundred and thirty-seven times more oxygen than the skin.

The amount of $CO_2$ excreted, compared with that excreted by the lungs, is as 0.0089–0.0102 to 1, according to Seharling. Reinhard fixes the daily amount of $CO_2$ excreted by the skin at 2.23, and Aubert at 3.87 grammes.

This amount is increased by increased temperature of the air, by muscular exercise, and other conditions which augment the flow of blood to the skin and the excretion of sweat.

Water is usually eliminated by the skin in the form of vapor, and only when the flow is increased specially, does it appear on the surface in the form of drops. The amount of water excreted in twenty-four hours is about 600 grammes, or not far from double that thrown off by the lungs. In reality, however, the average cannot be determined, since the amount of water varies with the season, the place, individual, etc., to such a marked extent.

Among these factors is, first of all, the condition of distention of the blood-vessels of the skin. This in turn depends upon the clothing, the quality, quantity, and temperature of the food and drink, upon the bodily movements, and especially upon the temperature, moisture, etc., of the surrounding air.

If the water excretion increases to a too great extent, or if evaporation is prevented, the secretion of sweat makes its appearance.

## THE SECRETORY FUNCTION OF THE SKIN.

The fluid secretions of the skin are the sweat and the sebum.

The solid substances thrown off from the skin consist of the cells of the epidermis, which are removed mechanically by rubbing, washing, etc., after the horny layer has been macerated by warm bathes, warm and moist applications, diaphoretic procedures, etc. The most superficial layer of the epidermis, by virtue of its hygroscopic properties, swells up, and it can then be rubbed off.

### THE SECRETION OF SWEAT.

The sweat is chiefly secreted by the sudoriferous glands. That the sebaceous glands have some share cannot be denied or affirmed. It is not impossible that some sweat is secreted from the lymph-spaces directly through the sudoriferous ducts, and also that gases and watery vapor are thrown off in this way.

Krause endeavored to show that the surface of evaporation of the entire sudoriferous apparatus is only sufficient for the separation of one-eighth to two-ninth of the entire perspiration. The remainder must, therefore, pass through the epidermis itself.

Against this view it must be said that an accurate estimate of the superficial area of the sweat-glands and ducts is impossible; also that the evaporating surface is largely increased by the spreading-out of each drop of sweat upon the skin.

Erismann has shown that a much greater amount of water can be evaporated by the sweat-glands than Krause estimated. Furthermore, he has shown that the surface of the dead body excretes only one-sixth to one-fifth of the amount thrown off by the living body. In other words, at death the activity of a special organ ceases—an organ which in life has the power, on the one hand, constantly to deliver up water; on the other, to increase in a high degree its evaporating surface. As the epidermis is not changed at death, this organ must consist of the glandular organs of the skin, particularly the sweat-glands.

The sweat is a watery, almost colorless and clear fluid, of acid or alkaline reaction, salty taste, and a peculiar odor varying with the locality and the individual. The sweat contains volatile fatty acids (formic acid, acetic acid, butyric, propionic acids, etc.), and also neutral fats in small amount (palmitin and stearin), and cholesterin.

There can scarcely be a doubt that the sudoriferous glands have an active share in lubricating the epidermis, and that the secretion of the sebaceous glands is especially for the oleaginous needs of the hair.

According to the general view, the reaction of the fresh sweat is normally acid; if a profuse secretion is artificially induced by jaborandi, or other diaphoretics, and be kept up for some time, the reaction becomes neutral or even alkaline. The reaction also changes if the secreted sweat is allowed to stand a long time, in this case there being a decomposition of the nitrogenous constituents, especially urea, with the formation of ammoniacal salts.

Luchsinger and Trümpy found the reaction of the fresh sweat constantly alkaline when that part of the skin examined is first carefully cleansed of the sebum. The acid reaction of the sweat from the uncleaned skin depends, according to Luchsinger, upon the admixture of the uniformly acid sebum. The reaction of the sweat in the vola manus, where there are no sebaceous glands, is constantly alkaline.

It must not be forgotten, however, that Luchsinger and Trümpy examined only the sweat-secretion artificially increased and therefore not perfectly normal. Urea is a normal constituent of sweat and exists in the proportion of about 0.1–0.2 per cent. Whether

variations take place under normal conditions remains still to be determined. Under pathological conditions, for example, in anuria in the course of nephritis scarlatinosa and cholerica, and nephritis suppurativa from nephrolithiasis, the excretion of urea may be so increased that upon evaporation of the sweat, crystals appear upon the surface of the skin.

The presence of other nitrogenous bodies as normal constituents of the sweat has not so far been uniformly observed.

Leube found in profuse sweat a small amount of albumin. Schottin found a rose-red pigment precipitated by alcohol, and turned bright-green by oxalic acid. Finally Favre found an acid containing nitrogen (hydrotic acid).

The inorganic salts in sweat exist, according to Funke, in the proportion of 0.099–0.629 per cent (average 0.329 per cent). The principal ones are the alkaline chlorides, especially chloride of sodium. In less amount are the alkaline and earthy phosphates and the oxide of iron.

The amount of water in sweat varies from 977.40 (Schottin) to 995.573 (Favre). These variations depend upon the amount and duration of the sweating, the food, the amount of water taken during the sweating, etc.

The process of secretion is periodic, being determined by certain causal conditions.

It is a true secretion dependent mainly upon nervous influence, and is analogous in many points to the secretion of saliva.

The centres for the sudoriferous nerves are situated in the spinal cord as far up as the medulla oblongata, which latter contains a general centre containing the spinal centres (Luchsinger).

The peripheral paths of the sweat-nerves follow the rami communicantes to the sympathetic, and then pass into the mixed nerves of the extremities. Some fibres pass directly to the extremities (Vulpian, Adamkiewicz), though this is denied by a competent observer (Nawrocki).

The terminations of the sweat nerves upon the sudoriferous glands have been demonstrated by Coyne by the gold method. Whether they pass into the cells and how is as yet unknown.

Irritation of the mixed nerves containing sweat fibres excites in animals secretion of sweat within the distribution of the nerve. Pilocarpine, muscarine, and other alkaloids stimulate secretion by acting upon the periphery. For example, they will excite sweating after section of the nerve trunk from its centre.

The secretion of sweat is increased through reflex and central stimulation by changes in the temperature and composition of the blood, especially by increase of its heat and by venosity, poisoning with strychnine, picrotoxine, camphor, ammonium aceticum.

The glandular activity is diminished or even entirely suspended by cooling the skin, cutting off the supply of arterial blood, separation of the glands from the central nervous system, finally by too long activity, and apparently also by too long rest.

Simple venous stasis without dyspnœic condition of the blood does not stimulate the sweat-glands; neither does active hyperæmia up to the point of inflammation. Similarly a simple increase in the arterial pressure is without effect, as, for example, when a large amount of water is taken into the system, unless the blood is heated by the imbibed fluid, or by a high temperature of the surrounding air, or by prevention of heat-radiation and water-evaporation from the skin, or by muscular activity. The secretion of sweat is so far independent of the blood-vessels and the vaso-motor nerves that it can

still be excited by irritation of a nerve trunk even when the limb is severed from the body (Kendall and Luchsinger), but it is accompanied by dilatation of the blood-vessels and increased by a powerful flow of arterial blood.

Atropine causes a diminution or even cessation of the sweat-secretion by paralyzing the glandular nerves, while, as Rossbach has apparently shown, the specific irritability of the glandular substance persists and can even be excited by pilocarpine, although the strongest electrical irritation of the nerve is ineffectual.

Medical experience confirms the power of atropine to check perspiration, *e. g.*, in the profuse sweats of phthisical, rheumatic, and other patients. In a less degree, morphine acts in the same manner, both in physiological experiment and with the sick.

Chloroform, chloral hydrate, ether, and curare do not lessen the activity of the sweat-glands even in the largest doses. The existence of inhibitory sweat-nerves in the sympathetic has lately (Vulpian) been announced, but not confirmed.

## THE SEBACEOUS SECRETION.

Sebum consists in healthy individuals of a fluid fat, which, passing out insensibly from the sebaceous glands, lubricates the epidermis and hair, though not giving them a noticeably oily appearance. Herein, however, there are many variations within the limits of health, especially as regards increased secretion and abnormal consistency—too solid or too fluid. In these cases one notes either that the skin and hair always present an oily appearance, that the mouths of the ducts on the nose and vicinity gape; or, if the consistency of the sebum is increased, that it appears at the openings of the ducts in white, tallow-like masses.

The microscopic examination of the sebum shows, besides free fat, more or less fatty cells, cell debris, cholesterin crystals, and epidermic scales.

The chemical composition of the sebum and allied secretions, the ear-wax, smegma preputii, and secretion of the Meibomian glands has been incompletely studied. The constant constituents are: water, fats (palmitin and olein), palmitic and oleic acid, soaps, a casein-like albuminoid, cholesterin, and inorganic salts (chlorides and phosphates of the alkalies and earths).

C. Schmidt examined an old and rancid accumulation of sebum of gigantic size, which, on account of its age, did not represent the normal secretion, and found: water 31.70%; fatty acids (butyric, valerianic, and caproic), 1.21%; palmitin with a trace of cholesterin, 4.16%; epithelium and albuminate, 61.75%; mineral salts, 1.18%.

Ear-wax is a mixture of the secretions from the sudoriferous and sebaceous glands of the external auditory meatus. Microscopically the formed elements of these two secretions can be recognized.

So far as has been determined, the secretion of sebum is continuous and is increased by increase of vascular supply and of temperature. The central layer of the gland-cells is filled with fat-drops, the cells rupture after coalescence of the drops of fat, and free fat is formed.

The analogy between the sebaceous and lacteal secretion justifies the view that the contractility and permeability of the membrane for fats, demonstrated by Stricker and Schwarz[1] for the colostrum cells, exists also for the cells of the sebaceous glands, so

[1] Sitzungberichte der k. k. Akademie der Wissenschaften zu Wien, Mathem.-naturwiss. Kl., ii. Abthlg., Bd. liii., S. 184.

that the freeing of the fat from the cells does not necessarily imply that the cell is broken up.

## THE FUNCTION OF HEAT REGULATION.

The regulation of the amount of heat lost from the surface of the body is essential to the preservation of a constant temperature of the blood, and thereby to the preservation of life.

The heat lost from the cutaneous surface passes off by radiation and conduction, as well as by the evaporation of water. Increase or decrease of the surrounding temperature gives rise, through reflex excitation of the vaso-motor centres, to a narrowing or widening of the cutaneous blood-vessels, and a relaxation or contraction of the smooth muscles of the skin. It cannot be denied, *a priori*, that these effects may be brought about in part by indirect excitation of the smooth muscular fibres of the vessels through temperature changes without the intervention of the nervous system.

In cooling the skin, the amount of blood sent to it is enormously decreased through narrowing of the blood-vessels. By the contraction of the muscles of the skin, also its superficies is reduced to a minimum. In this way, the heat lost from the body surface is not only diminished, but the cooling of the blood itself is lessened. On the other hand, with increase of external temperature, the blood-vessels are dilated, the skin muscles relaxed, consequently more blood circulates in the surface, the superficies of which is at the same time increased. The sweat secretion is of fundamental importance in certain degrees of temperature increase in order to prevent heating of the blood. On account of the passage of drops of sweat from the ducts out upon the surrounding skin, a great amount of heat is rendered latent.

## THE FUNCTION OF THE SKIN AS A SENSORY ORGAN.

The function of the skin as a sensory organ depends upon the integrity of the peripheral nervous end-organs and upon the unbroken continuity between these end-organs and the nerve centres. The subject is discussed in Vol. XII. under the head of "Diseases of the Peripheral Nerves."

## THE FUNCTION OF THE SKIN AS A PROTECTING ORGAN FOR THE SURFACE OF THE BODY.

The horny layer of the epidermis limits the evaporation of water from the surface which otherwise would go on continually. On the other hand, it opposes strongly the passage of caustic and poisonous fluids, of electricity, and of very high or low degrees of heat, and, to a certain extent, the entrance of poisonous gases when the surface is sufficiently lubricated with sebum.

The elasticity and toughness of the cutaneous tissue are also a protection against injuries of all kinds. The hair, especially that of the head, acts as a protection against thermal and mechanical injuries.

## THE DISTURBANCES OF THE GENERAL FUNCTIONS OF THE SKIN.

Covering the skin with an impermeable layer (varnish, oil-paint, etc.) acts very differently upon different animals. In rabbits, varnishing, after removing the hair, sooner

or later produces death. The fatal termination occurs more rapidly the smaller the animal and the more completely the cutaneous surface is covered. It is sufficient, in most cases, to cover only a third of the body in order to produce death, and even varnishing a sixth part may prove fatal.

The symptoms are those of an acute febrile disease, which, after great diminution in temperature, ends fatally. At first, one observes weakness, increased rapidity of the circulation and respiration; soon these latter become slower, the temperature falls, the animal is apathetic, insensible to irritations; albuminuria, convulsions, and paralyses follow, and a fall of temperature to 19°–20° C. (in the rectum) results, the $CO_2$ exhalation sinks (even to one-half of the normal), and death takes place.

According to the recent experiments of Ellenberger and others upon larger and less sensitive animals, the effects of varnishing are decidedly less marked than is the case with rabbits.

Senator has recently investigated this question anew, and has sought to determine whether the results upon animals can be applied to man. The single observation which illustrates the deleterious effect of varnishing upon man is, as Senator shows, not a strong evidence. At the installation of Pope Leo X., a poor boy was gilded over his entire skin. The child was taken sick and died the following night. Senator rightly contends that this shows nothing, since we are not told what symptoms occurred, and whether the substances used in gilding were not poisonous. The fact of death occurring so suddenly speaks against its being due to the gilding, reasoning from the mode of death in lower animals, since dogs survive varnishing for several weeks.

Senator has made a number of experiments, partly upon febrile (typhoid) and partly upon non-febrile adults. He applied to the skin an impermeable coating of adhesive plaster, collodium ricinatum, or tar, and allowed it to remain several days. This did not produce any morbid symptoms, much less fatal results. Decrease of the internal temperature did not once take place if cooling of the surface, from long exposure or evaporation of ether, was prevented.

Hence it appears that covering the cutaneous surface with an impermeable coating is, in man, or at least in adults, not dangerous.

Covering the entire skin with tar and tar preparations produces indeed some morbid symptoms, but no dangerous results. If more than a third of the body is covered with tar, there is produced a high fever with distress, malaise, headache; in vomiting, a dark-brown fluid is sometimes thrown up, and the fæces have sometimes a dark-brown color; most constantly, the urine has a greenish-black appearance, due to the presence of tarry constituents. Whether these enter the blood by the skin or lungs is not yet determined. At all events, we are justified in assuming that these morbid phenomena are due not to suppression of the perspiration, but rather to absorption of the constituents of the tar.

## THE ABSORPTIVE POWER OF THE SKIN AND ITS LIMITS.

The horny layer of the epidermis is that part of the skin which, lubricated by the sebum, reduces to a minimum the absorption of substances applied to it in solution. If the epidermis is removed, the papillæ exercise a powerful absorptive capacity. Small excoriations and abrasions of the epidermis allow soluble substances to be taken up. But the question whether and to what extent the uninjured epidermis possesses an absorptive power is not yet finally settled. The practical importance of this matter is apparent in view

of the daily application of ointments, liniments, etc., to the skin. Physiology is not less interested in the scientific aspect of the question.

As regards the paths of absorption, the cutis, with its rich supply of juice-spaces and lymph-vessels, and the subcutaneous tissue to a still greater extent, offer favorable conditions for absorption.

The epidermis alone, particularly the horny layer, presents obstacles. In experimentation, it must be first carefully ascertained that no excoriations, cuts, or lacerations are present; that the openings of those canals which are covered with mucous membrane (vagina, urethra, prepuce) are not included in that portion of the skin examined; finally, that the absorption of volatile substances by the lungs is excluded.

The histological structure of the epidermis does not exclude, *a priori*, its permeability to fluids and gases. The superficial horny layer alone forms a firm layer only interrupted at the mouths of the hair-follicles and sweat-glands. But here, indeed, there is an opportunity for fluids to enter the deeper layers of the epiderm towards the stratum lucidum without calling into play any absorptive capacity of the glandular substance itself.

V. Wittich has contended strongly of late that between the cells of the horny layer in the septum lucidum there are spaces communicating with each other, and filled with granular cement substance which probably communicate with the juice-canals of the cutis, and constitute the path of communication between the surface and the fluids of the body. They would also allow nourishing juices to pass from the papillary layer to the superficial parts of the epidermis, and carry off the watery and gaseous constituents of the perspiration; it could, on the other hand, under favorable circumstances, assist in absorption of fluids and substances in solution.

These paths contain the star-shaped wandering cells of Biesiadecki which reach with their processes into the corium, and serve for the passage of gases and easily soluble substances between the epidermis and cutis.

The above description harmonizes completely with the phenomena of vesication resulting from thermic and chemical irritation.

The filtration capacity of the epidermis is, according to V. Wittich's experiments, extremely small, although not entirely absent. But its permeability can be increased at any time by soaking the horny layer and loosening its texture. This especially occurs when substances are pressed into the orifices of the glands and distend them.

We will first consider the simplest condition of absorption.

*Water*, applied to the uninjured skin, is not absorbed. The experiments with long-continued baths give indeed an increase in the body weight, but this depends in all probability upon imbibition of water by the epidermis, not upon water absorption. All experiments at least in which the water of the bath contained in solution substances which could be easily detected in the excretions or secretions, have given negative results; provided the necessary precautions were used.

Most experiments have been made with the salts of iodine. The careful experiments of Braune gave invariably negative results.

Fleischer has lately made very careful experiments. He inclosed a limb in a glass vessel containing water kept at an even temperature. By means of a communicating pipette he determined the level of the fluid, after covering it with a layer of oil to prevent evaporation. If now the skin absorbed any water, the height of the fluid in the pipette would sink. After several hours this took place to such a small extent that Fleischer concluded that the epidermis imbibed some water, but that none was absorbed.

The skin similarly does not absorb alcoholic solutions of various substances if the tinctures are simply brushed upon the skin.

On applying to the skin various watery solutions by means of the spray-apparatus, Röhrig found iodine in the urine and saliva after twenty minutes. After one to two hours he found ferrocyanide of potassium in the urine. V. Wittich and I, who repeated this experiment with slight modifications, constantly obtained negative results. It is, therefore, doubtful at least whether absorption takes place after simple spraying.

The case is somewhat different in rubbing upon the skin substances dissolved or suspended in fat or oil. In some cases absorption then takes places apparently through the mouths and ducts of the glands into which the fat is pressed. But in most cases nothing is absorbed.

Lassar[1] holds the view, based upon observations upon rabbits, that fats and the substances contained in them are absorbed to an unlimited extent, probably at the mouths of hair-follicles. Fleischer obtained negative results with ointments of potassium iodide, morphine and veratrine, while the results were sometimes positive, sometimes negative, with ointments containing salicylic acid.

It cannot be doubted that mercury rubbed upon the skin in the form of an ointment is absorbed. How and in what form mercury is taken up by the skin is a question regarding which there is not yet harmony of opinion. Röhrig thinks that the greater part is absorbed in the form of mercurial vapor. Others believe that the mercurial particles enter through the mouths of the hair-follicles or sebaceous glands (Neumann) or pass through the superficial layers of the epidermis (Rindfleisch, Fleischer). According to v. Bärensprung, the oxide of mercury, which is always present in mercurial ointment, can alone be absorbed and become active. This is dissolved by the free acid of the sweat, and so is absorbed.

*Gases and substances which easily become volatile at relatively low temperature pass through the skin with considerable readiness.*

The diffusion of gases through the epidermis takes place most easily of all. This has long been proven experimentally with regard to hydrogen sulphide, carbonic oxide, carbonic acid gas, chlorine, prussic acid, and other gases. Röhrig has lately obtained positive results in experiments with these gases and with chloroform, illuminating gas, etc. He has also shown that baths, if the water is saturated with these gases, produce characteristic symptoms of poisoning.

The absorption of volatile substances, such as turpentine, camphor, etc., very readily takes place through the intact epidermis.

The circumstance that the difficulty of absorption is increased by the presence of an oily stratum upon the skin is one of importance, and absorption is aided by the removal of this layer by means of ether, alcohol, or chloroform. According to my experiments, based on those of Röhrig, the solutions of pilocarpine, apomorphine, salicylic acid, etc., in ether or oil of turpentine, powerfully sprayed upon the skin, were absorbed to the greatest extent when the skin had first been washed with soap or ether. The quantity of the substances which can be taken up in this way, however, is so small that no practical significance can be attached to it as a method of administering drugs.

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Although it is certain that watery solutions of organic and inorganic salts are not

[1] Lassar, Virchow's Archiv, Bd. 67, 1.

absorbed by the uninjured skin, yet therapeutics receives compensation in the doctrine of the irritating action of saline solutions upon the ends of the peripheral nerves and, by means of centripetal conduction upon the central nervous system and upon the metabolic processes.

We can further affirm that the absorption of gases and volatile substances by the skin takes place. Should it be further established that medicinal substances dissolved or suspended in these easily volatilized substances (alcohol, ether, oil of turpentine, etc.) are also taken in by diosmosis, the limits of epidermic therapeutics will be somewhat, though for practical purposes not very greatly, enlarged.

Finally, the absorption of substances dissolved or suspended in fats when mechanical pressure is employed cannot be denied.

# GENERAL

# PATHOLOGY AND THERAPEUTICS OF THE SKIN.

BY

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## I. GENERAL NOSOLOGY OF THE SKIN.

The pathological features of diseases of the skin correspond entirely to those of the diseases of organs in general. It is clear, however, that this subordination to general pathological laws can only be carried so far as the structure of the skin, and the character of its functions, do not require an individualization. However, each individual pathological process, in such a highly complex organ as the general tegumentary covering, will present a picture which is not simply a repetition of the same nutritive disturbance in another organ, for example, the liver.

The history of the pathology of the skin, indeed, presents a constant vacillation between complete denial of its individuality and its entire separation from the general pathological types. The most suitable method to be adopted appears to be that of comparative pathology.

We find that the *mucous membrane* consists of the same layers as the external integument, except that its epithelium is destitute of the horny layer, and there remains merely the laminated pavement epithelium, in addition to the basal layer of cylindrical (prismatic) or round cells, the latter being situated directly upon the connective-tissue stroma, as it is in the skin. From the cardiac extremity of the stomach to the anus, in a part of the air passages, in the male urethra and vas deferens, and in the female genitals from the external os uteri, *i. e.*, wherever the mucous membrane is not directly in contact with the air, the epithelium of the mucous membrane is formed merely of one or more layers of large cylindrical cells, which are ciliated in some parts.

In the larynx and the remainder of the respiratory tract, etc., the connective-tissue stroma is not provided with papillæ; the remaining mucous surfaces present a more or less distintly marked papillary boundary which, in the intestines, appears in the shape of the intestinal villi. The lingual and vaginal papillæ each have a special epithelial covering.

The secreting glands are situated in part in the mucous membrane itself, in part in the submucous connective tissue. Certain tracts, for example, the bladder and vagina, contain no glands.

The casting off of the external epithelial layer, which manifests itself in the skin as desquamation, occurs in the mucous membranes in the form of a secretion of mucus.

The serous and synovial membranes are covered with a single layer of pavement epithelium, the cells of which, from their origin, are regarded as connective-tissue cells, and are distinguished from true independent epithelium cells. In the serous membranes there is no papillary structure.

It may be inferred from these brief hints that the chief difference between mucous and serous membranes and the external skin lay, in great part, in the epithelial layer of the former compared with the other layer of the skin, and furthermore in the follicles which are found in the tissue of these membranes, while the basal connective-tissue layers do not differ essentially from one another in their types.

In so far as a part of the diseases of the skin is attributable to a congenital abnormal growth of the epidermis as a whole or in individual layers, or to an anomaly in the physiological processes, a decisive difference will be presented in this respect from the anomalies of the mucous and serous membranes, covered with more delicate layers of epithelium cells. In a similar manner, various irritants will produce varying effects, according as the outer covering is an elastic resistant membrane, as in the integment, or is a delicate, easily-ruptured but easily-replaced layer, as in the other membranes.

Similar relations are recognizable between the glandular structures of the skin and those of other organs, as, for example, between the glomeruli of the sweat glands and those of the kidneys.

We may point also to certain similarities which exist between the skin and mucous membranes with a thick epithelial covering and profuse papillary formation, for example between the palm of the hand and the tongue, and to the fact that certain simple, hyperplastic epithelium affections mainly occur in both places. It is a striking fact, on the other hand, that that form of neoplasm which arises from a typical epithelium proliferation (epithelioma or cancroid) appears to be confined in the skin, as in the mucous membranes, to the papillary developmental form of the boundary, that accordingly it occurs only in those parts of the mucous membrane in which the papillary form is distinctly marked (the œsophagus, cervical canal of the uterus, etc.).

It would be easy to multiply analogies, but we will content ourselves by emphasizing again the statement that the pathological types in the skin differ indeed in many respects from those of similar organs, but that these differences must be attributed directly to differences of form in their development and structure—to a *genius loci*, which disappears at once when the structure of other organs approaches that of the external skin.

If we consider the morbid processes of the skin as a whole, the fact at once forces itself upon us that it is by no means easy to form such sharply-defined groups of symptoms that they can be clearly distinguished from other groups by their origin and method of development, their peculiar subjective and objective characteristics, their course, prognosis, and reaction to curative agencies. Then the observation is added that certain irritants, coming from the outside or developing in the organism itself, are related to these changes; at the same time that one and the same irritant may correspond to various deviations, one and the same deviation to various forms of irritant. The morphology of diseases of the skin constitutes a whole which is full of details, but comprehended with difficulty, and it is scarcely possible to make a dry enumeration and classification of all these changes really attractive to the reader. We will lay stress, therefore, only on those features in the general pathology of the skin in which the general pathological law is clearly expressed, whether in harmony with the processes in other organs or in contrast to the latter.

## THE INFLAMMATORY NUTRITIVE DISTURBANCE IN GENERAL, AND THAT OF THE SKIN IN PARTICULAR.

The various irritants which act upon the integument give rise to various processes in the tegumentary organs, which may all be termed nutritive disturbances, but are to be distinguished from one another according to the predominance of this or that factor. Among these disturbances one category has always been regarded as a separate group, for which the general term inflammatory processes has been chosen, the causal factors of which have been termed "inflammatory irritants," and to which certain clinical features, indicated by the words "calor, rubor, tumor, dolor, functio læsa," have been ascribed.

At the outset we will assume that "inflammation" of the skin, as well as of other organs, must be conceived as something which is developing, changing, never as something which is stationary, finished.

The inflammatory process in the skin is characterized:

*a.* By changes in the circulatory apparatus which may increase from distention of the vessels to abnormal exudation, to the passage of blood-corpuscles and plasma through the walls of the vessels (hyperæmia and exudation).

*b.* By changes in the nutrition and growth of the tissue elements produced thereby (parenchymatous inflammatory processes, changes in the shape of the cells, and nuclear proliferation of the "stationary" elements).

*c.* By changes in the peripheral, sensory, and motor nervous apparatus (pain and functional disturbance).

Which of these factors is to be considered primary, is still entirely unsettled at the present day.

If we confine ourselves, therefore, to regarding the inflammatory process as co-ordinate with the vascular, parenchymatous, and nervous processes, and to considering it as the result of certain irritants with which experience has made us acquainted, we will finally be able, from a clinical standpoint, to overlook the fact that the manner, situation, and period of the beginning of the action of these irritants are still entirely in the dark, despite numerous experiments. However, we will be compelled, at the outset, to ask ourselves the question: is the inflammatory process, although not comprehended *pathogenetically* as a whole, to be regarded at least as a readily defined, sharply bounded *clinical* entity? The answer is not an unqualified affirmative; a strict definition of the process is impossible at the present time, and its boundaries have not been completely defined.

Accordingly, we must add the following explanation:

*a.* Every pathological process which presents the above-mentioned characteristics is inflammatory.

*b.* It is not necessary, however, that all the factors should be present or demonstrable. This is true to the least extent of the nervous symptoms, which are quite often absent. Furthermore, the parenchymatous processes may often be so slight and temporary, that they escape observation, or they become stationary, and are converted into tissue diseases of a peculiar kind. Finally,

*c.* With regard to the circulatory processes, the clinician is justified in saying: *there is no inflammatory process without a change in the walls of the vessels* (Cohnheim), although these may attain but a slight grade.

It is best to call this process (with Virchow) fluxion, and to understand by this term all those changes in which, as the result of so-called inflammatory irritants, a change has been produced in the structure of the walls of the vessels which, with Stricker, we

may term a return of the tissue elements to the embryonal condition of the cellular elements, which had become fixed, to amœboid organisms. Accordingly no form of so-called stasis can be called an inflammatory process, *unless associated with change in the walls of the vessels.*

The latter gives rise either to the so-called "itio in partes" of the white blood-globules and their passage through the walls of the vessels, or it does not go so far, in which event clinical experience or direct experiment teaches us that merely a *quantitatively* smaller irritant action, not a *qualitative* difference of the pathological process must be regarded as the cause of the phenomena of inflammation which have not reached their full height.

All these processes, *i. e.*, all hyperæmias produced by such factors which, as a matter of experience, would be followed by inflammatory exudation under other circumstances, must be included under the conception of inflammation.

On the other hand, there are no true, purely parenchymatous inflammations, *i. e.*, which run their course without fluxion and exudation.

It might be claimed that there are also hyperæmias which do not lead to the inflammatory alteration of the vascular walls and to changes in the tissue elements. But the changes belonging in this category, such as blushing and cyanosis, must be regarded simply as physiological or pathological changes of the *degree of distention* of individual parts of the circulatory apparatus, therefore not as inflammatory processes in the skin.

All other hyperæmias belong to the inflammatory processes and differ only in degree from the exudative processes. An erythema traumaticum is exactly the same process as an eczema traumaticum and may pass into the latter.

But one thing must be mentioned in this connection: in a complicated process like inflammation, we have to deal, in many cases, with transition forms as in all natural processes. Active inflammations never occur without the development of venous changes, and *vice versa.* We may, therefore, speak only of the *predominance of one or the other form.*

After this general elucidation of the conception of inflammation, we will pass to a description of the inflammatory process upon the skin in particular.

### *a.* THE SUPERFICIAL INFLAMMATIONS OF THE SKIN.

If a moderate irritant of a thermal, chemical, or mechanical nature is allowed to act upon a portion of the integument, thus, for example, the neck of a lady exposed for some time to strong sunlight, or the skin merely rubbed vigorously with a coarse towel, we will give rise to the alteration which is termed arterial congestion or fluxion. The skin appears warmer, it becomes of a bright-red color, which disappears entirely under the pressure of the finger, but returns forthwith; it feels somewhat thicker, firmer, tenser (more turgescent), and gives rise, at first, to itching, then to burning. The rosy-red spots are due to the fact that the upper layer of the corium which contains the final ramifications of the vessels, does not allow the contours of the individual vessels to be apparent, but rather vague spots of redness. When these spots occupy more extensive surfaces, the redness is usully termed erythema; when they occur more diffusely in smaller patches, it is called roseola.

The latter variety of hyperæmia, however, is often merely the initial form, and passes into erythema in its further course. For inflammatory irritants usually act upon the skin in such a manner that they affect, at first, the small supplying artery which constitutes the centre of a small vas-

cular district (to which, as a rule, a few papillary vascular meshes belong). Here the earliest trace of redness is first shown, and as the centre of such a vascular district often corresponds to the centre of the vascular circle which is formed under each follicle of the skin, this punctate redness often appears as a darker central elevation which is formed by the excretory duct of the follicle.

If the hyperæmia then spreads to the collateral branches, it also involves the hitherto intact portions of the skin between the individual spots and forms indefinite, larger patches of erythema. This condition increases to a certain extent, and then the individual symptoms gradually diminish and disappear. Either no trace of the entire process remains or, at the most, a moderate desquamation.

The arterial fluxion here described, which may be produced also by internal causes, corresponds entirely to the hyperæmic redness of the mucous membranes, except that in the latter, the epithelium of which is more delicate than the epidermis of the skin, the ramifications of the distended vessels themselves appear more sharply defined; secondly, that the process leaves behind an increased secretion of mucus.

This description corresponds exactly to the results of the parallel experiment in animals.

If a rabbit's ear is brushed with very dilute mustard oil, it presents within about three-quarters to one and a half hour a rosy redness and elevation of temperature and, under a magnifying glass, a moderate dilatation of the arteries, then also of the veins, which phenomena disappear within a few minutes to half an hour, and give place to the normal condition. Exceptionally some swelling of the entire tissue occurs, but this also disappears after a while.

The swelling of the tissues constitutes the transition to more severe forms of arterial fluxion in which more profuse transudation of blood plasma is added to the simple congestion, which soon disappears, and, at the same time, a larger number of white blood-globules appear to be mingled with the serum. We are justified in calling these appearances *inflammatory œdema* in Cohnheim's sense.

This inflammatory œdema complicates the majority of hyperæmias of the skin to a lesser or greater extent, provided that the irritant is not too weak, or its action has not been too brief.

Let us now assume that an irritant acts more intensely or for a longer period upon the rabbit's ear or the human skin; for example, more concentrated mustard oil is brushed upon it several times in succession.

In the rabbit's ear the experiment teaches the following: dilatation of the arteries, veins, and capillaries first occurs together with increased rapidity of the flow of blood, and redness, swelling, and some elevation of temperature of the concha, which phenomena disappear after some time. A few hours later, rosy redness, heat, and swelling again make their appearance, while the flow of blood in the neighborhood gradually becomes slower, and stasis develops in the capillaries. Corresponding to this, red dots and streaks (small hemorrhages) develop upon the ear; in certain cases, finally, vesicles form which, when they burst, leave spots destitute of the epidermis and from which a serous or bloody fluid flows. At this period the microscope shows, in the veins, the peculiar accumulation of the white blood-globules along the walls of the veins and which is soon followed by the extravasation of white blood-globules from the veins and capillaries, and red-globules from the capillaries.

The following are the appearances upon the human skin as the result of the parallel experiment:

First, filling of the vessels, diffuse rosy redness, which disappears upon pressure, an evidence that it is due to dilatation of the vessels; at the same time, elevation of temperature; pruritus, then pain, swelling, and thickening of the skin from the occurrence of a

fluid exudation, by which the ecchymoses—which occur occasionally, but not always—are concealed; finally, the formation of various changes upon the surface of the skin which have been called inflammatory efflorescences by pathologists.

The appearances found in inflamed skin shortly after death show that the process is in all respects analogous to that in the skin of the rabbit.

We possess more accurate direct knowledge, however, concerning the stage of exudation. In this stage, the inflamed tissue in the vicinity of the vessels, *i. e.*, the corium proper and especially its papillary layer, is found:

*a.* Moistened by transuded blood plasma.

*b.* Infiltrated with red, and, to a large extent, white blood-globules from the vessels.

A nutritive change is thus produced in the corium itself, which manifests itself by the following phenomena: the protoplasm of the cellular elements of the connective tissue becomes swollen, their nuclei appear to be increased, nuclear division and cell fission occur to a more marked extent, and thus soon presents to the eye filling of the entire connective-tissue layer around the vessels with young uninuclear and multinuclear cells of the most varied form, with and without processes, between which are free nuclei, singly and in groups. During these processes the fibrous connective tissue and elastic tissue remain free from any noteworthy change, and no distinct abnormality can be detected in the glands, their excretory ducts, and the adipose tissue. The epidermis, however, presents a different condition. Its implication gives rise to the development of efflorescences (anthemata) and in the first place,

1. *To the formation of spots and nodules.* The first change in the tissue of the corium, the hyperæmia, corresponds to a greater succulence of the cells of the epidermis, especially the lowermost, youngest ones, then the so-called stratum lucidum, the basal horny layer, the contours of the cells and nuclear remains of which again begin to show more distinctly.

While the changes in the papillary layer spread farther, and the papillæ and then the deeper layers of the cutis become filled with fluid and cellular inflammatory transudation, the succulence of the elements of the epidermis also increases, so that it appears enlarged in depth, inasmuch as its outermost boundary, formed superiorly by the horny layer and inferiorly its boundary towards the papillæ, pushes itself forward, and a more marked projection of the thickened interpapillary cones into the tissue of the corium may be recognized.

For this reason also, the papillæ appear to be elongated, although the rigid boundary between the epidermis and the cutis, formed by the lowermost cylindrical cells of the Malpighian layer, does not appear displaced or present itself less sharply.

The slight elevation of the surface produced by this process is concealed usually by the change of color, and the entire change in the integument is called a spot or macula.

The following further advance in the process now occurs: the individual vascular tracts or territories of the papillary layer, which correspond to separate districts of erythema, appear more sharply defined as individual districts of swelling, above which also the cells of the Malpighian layer become swollen, without losing their serration, while their nuclei appear less distinct or become divided (Renaut). Elevations of the epidermis thus develop in patches which correspond to the irregular infiltration of the tissue of the corium and the corresponding protrusion of the epidermis, and become visible to the naked eye as inflammatory nodules, solid swellings of the skin, *i. e.*, as such whose fluid contents are still inclosed in the cellular elements which are swollen by its means.

Free fluid, *i. e.*, a larger accumulation of serum, pus, or blood between the corium and the epidermis or within the latter, does not occur during the nodular stage of the process.

If merely a moderate irritant has acted upon the skin and the quantity of exudation has not exceeded the absorptive capacity of the elements of the epidermis, the process either has reached its height with the diffuse hyperæmic swelling, the macula, or with the formation of the nodule, and the corium then gradually returns to the normal.

2. *Formation of vesicles and pustules.* If the intensity of the exudative process in the corium does not diminish, a process occurs in the hitherto solid-looking nodule which holds good for all vesicular and pustular formations. This is:

*a.* The swelling and granular opacity of the cells of the Malpighian network in the lower layers and the slight separation of the serrations from those of the other cells (præpustulation according to Renaut).

Then *b*, the formation of a meshwork within the projection of the epidermis belonging to the nodule.

Starting from the stratum lucidum, a transformation occurs of the swollen cells of the prickle layer of the rete into a very bright, transparent body of the shape of a lentil lying transversely, which is bounded laterally by dense columns of swollen cells; in the middle, however, a fibrous meshwork is formed by fibres and bands crossing one another in all directions, the meshes of which are composed of compressed, flattened elongated epithelium cells which, according to Unna, have undergone a sort of fibrinoid change, and the interspaces of which are filled with a moderate amount of serous transparent fluid and pus-corpuscles.

The cavity thus formed within the nodule, traversed by strands and filled with serum, converts this into another form of efflorescence, the vesicle. When looked at from above, this is a transparent, rounded elevation, the base of which is occasionally surrounded by a red, hyperæmic zone. The wall of the vesicle is more or less tense and occasionally shows, in the middle, a flat, plate-shaped, less transparent depression, an umbilication.

If pricked from above, such a vesicle allows only a few drops of serum to escape, because the partition walls of the meshwork prevent the simultaneous opening of the entire vesicle; if the entire top is cut off, we will notice on its lower surface a whitish-yellow layer, consisting of the ruptured strands of the network and loosened cells of the epidermis in a condition of fibrinoid change.

While the papillæ to the side of the vesicle have not changed their elevation, the papillary bodies below the middle of the vesicle commonly seem to be pressed downwards somewhat so that the epidermic portion of the vesicle rests as if in a flat saucer of the corium.

The process of vesicular formation ends either:

*a.* With the absorption of the contents of the vesicle without destruction of its wall; or,

*b.* With the rupture of the walls, and the discharge of the serous contents of the vesicle, often with the formation of crusts. If the vesicular walls have not ruptured until the process within has run its course, a fresh layer of cells of epidermis will have formed already and take its place. During an acute course, however, the walls often rupture before the exudative process has terminated; after the contents of the vesicle have escaped, there then remains a red deep spot which secretes considerable serous fluid, and at which the papillary body, covered merely with the layer of cylindrical cells, is laid bare.

Or, finally *c*, with the further development of the vesicle into other forms of efflorescence.

If the original irritant has been sufficiently strong to effect a marked extravasa-

tion into the corium and its filling with a larger number of young cells, the character of the process in the epidermis is changed in such a manner that the fluid contained in the meshes of the network is mingled with an increasing number of young cellular elements which cannot be distinguished from the young cells collected in the cutis and among which may be demonstrated, here and there, spheroidal accumulations of cells and nuclei, also bodies provided with processes (wandering cells, Biesiadecki), finally granular detritus and fat granules.

The contents of the efflorescence are now no longer termed serous but pustular, although there is really merely a quantitative difference between them, and the efflorescence itself is termed a pustule.

In its complete development, this forms a round, straw-yellow or grayish elevation of the surface, usually surrounded by a red zone, very little or not at all translucent, and the walls of which ordinarily are tensely drawn. It is often noticed that the umbilication which had been present in the vesicle is lost after the transformation into the pustule; in other cases, the umbilication does not become evident until the contents have become purulent.

Under the microscope, the network of the pustule, compared with that of the vesicle, appears more extensive laterally and inferiorly; furthermore the basal cell layer of the Malpighian layer underneath the network appears to be as densely filled with young cells as the papillary layer of the corium so that the boundary between both is indistinct or entirely obliterated.

3. *Further development and retrogression of the pustule.* In one series of cases, the cellular mass accumulated in the papillary layer is absorbed or is converted into normal connective tissue, without marked development of granular degeneration. The degeneration is then confined to the pustule itself, the fluid contents of which dry up, and together with the fatty, granular degenerated cellular masses, form a brownish crust which is laid bare by the bursting of the horny layer. Beneath this crust, however, and centrally from the lateral healthy cells of the Malpighian layer starting from the stratum lucidum (?) a new layer of cells has formed in the shape of a band between the incrusting pustular mass and the corium, its upper layers of cells being destitute of nuclei and appearing to be flattened; a new young epidermis has formed, above which lies the crust, covered by the original pustular wall, and thus inclosed as in a capsule. Finally, the old pustular covering falls off, the crust springs like a lentil out of its pod and pustulation is completed, leaving behind a newly formed, young, somewhat deeply situated epidermis, beneath which the papillary body returns to the normal. Umbilication belongs to the vesicular as well as the pustular forms; indeed, a central depression of the surface is observed occasionally in the first stages of the exudative process.

This depression is not produced by the traction of hairs or the like, but is the result of a disproportion between the space occupied by the network and the too small quantity of the exudative fluid in it. This umbilication, which v. Basch and I have termed the primary umbilication, often disappears as soon as greater tension occurs; it may also be produced when the covering is tightly stretched, *i. e.*, when no umbilication exists, by puncture and discharge of a small quantity of fluid.

But a second variety of umbilication may develop, when the pustule begins to dry, and from the same cause as the primary, viz., the disproportion between the space occupied by the pustule and the contents which are now being absorbed and drying up.

We will now consider those cases in which the nutritive disturbance is more active and long continued, and the upper part of the corium cannot remain master of the morbid changes. In these cases granular and fatty degeneration of the cellular masses and abscess formation occur, not only in the parts of the pustule which belong to the epider-

mis, but also in the papillary layer situated underneath it, indeed often extending into the depth of the corium. The abscess cavity extends from the top of the pustule down into the corium, there forms a suppurating loss of substance, an ulcer, and terminates in the development of cicatricial, band-shaped connective tissue, above which a new-formed, delicate epidermis has formed, starting from the lateral layers of the epidermis. The cicatrix left over after deeply-spreading pustules is thus developed, consisting of the flat, firm tissue of the corium destitute of papillæ, extending under a delicate epidermis.

*Superficial inflammation of the skin and catarrh.* In very thin parts of the skin, for example, in the points of transition of the skin into mucous membrane, hyperæmia manifests itself by an almost diffuse redness, as in true mucous membranes, and the termination in desquamation passes insensibly, in such places, into that of increased secretion of mucus.

In disturbed development of the epidermis, the nuclei of the Malpighian cells atrophy from excessive enlargement of the nuclear bodies. In desquamation, then, the former process takes the place of the latter; a number of cell nuclei atrophy instead of forming keratin, thus lose the resistance peculiar to the latter and the diseased epidermis cells are cast off in an incomplete state.

The normal secretion of mucus from the mucous membranes also constitutes nothing more than a desquamation of the peculiarly changed upper layers of the epithelium, which evidently corresponds physiologically, if not chemically, with the cornification and desquamation of the horny layer.

It is certain that in the affection of the mucous membrane we also have to deal with a disturbance of mucin formation, and also with an early desquamation of the cells of the epithelial layer which have not yet reached their highest development.

Every increase of the secretion of the mucous membrane associated with congestion, and which is produced by an inflammatory irritant, is termed a catarrh, and we assume various grades according as the desquamation of the mucin-containing epithelium cells occurs merely with a secretion of serous fluid or a more profuse formation of pus occurs (purulent catarrh). But such a catarrh is not simply an increased secretion of mucus in the epithelium cells or a more extensive transformation of collaginous and chondrogenous intercellular substance of the connective tissue into mucin. Its essential feature consists of the increased exudation of blood serum, mixed with more or less cellular elements, from the hyperæmic vessels into the tissue. The catarrhal secretion does not necessarily contain a larger amount of mucin, but rather a larger amount of serous fluid in which the mucin is dissolved. Under all circumstances the essential feature of catarrh of the mucous membranes is not increased secretion of mucus, but an increased sero-purulent exudation upon the surface.

Herein I find the justification for applying the term catarrhal dermatitis or catarrh of the skin to the analogous process in the external integument.

Upon the mucous membranes, also, efflorescences occur after stronger irritants, and especially upon those places which are covered with tesselated pavement epithelium. Here also we often observe larger and small transparent vesicles, and find erosions or even superficial ulcerations with suppurating surfaces left over upon their site, etc.

Under such circumstances the question cannot be shirked whether no form of superficial inflammation occurs upon the skin which not alone is anatomically and physiologically analogous to superficial inflammations of the mucous membranes, but also closely resembles, in its clinical history, the symptomatology of mucous catarrh. This clinical relationship would find its expression in a clinical history presenting as distinctly the character of a diffuse process, at least in a certain stage, as catarrh of the mucous membranes, and like this would respond in the same manner to external or internal inflammatory irritants as the external periphery of the organism. These conditions are indeed fulfilled by that morbid process of the external integument which we term eczema.

The fact really is, that the process histologically is entirely similar in both instances. On the whole, the histological examination of eczematous integument teaches nothing else than that of catarrh of mucous membranes; as a matter of course, however, varying according to the differences in the structure of the individual tissue layers of both organs.

In like manner the anatomical examination of eczema corresponds entirely to those appearances which we have described in the examinations of similar forms of efflorescence in inflammations of the skin in general. It is therefore entirely unnecessary to give detailed descriptions and appearances of the eczema process in this or that stage, and from this or that portion of the skin, which are so constantly repeated in the text-books.

However, I must call attention here to the most recent histological examination which Gaucher[1] made in a case of general eczema of long standing, and among which the following results are emphasized by the author:

1. Congestion of the papillary vessels, and infiltration of the corium with embryonal cells.
2. Transformation of the cells of the Malphighian layer into vesicles with complete disappearance of the nuclei (called by German histologists "dropsical swelling of the cells"), and complete destruction of central groups of cells in some interpapillary rete cones.
3. A partial separation of the epidermis which cannot be attributed to the method of preparation, and is not observed in normal integument.
4. Ulcerations upon the tongue (which have been left over evidently by the efflorescence).

The first point is entirely in harmony with the general appearances of inflammation in irritated skin.

The third point corresponds to the clinical appearances of the observed case, viz., a quite uniform œdematous swelling of the epidermis which had lasted some time. This also holds true of the fourth point.

With regard to the second point, however, perhaps investigation may render certain whether the above-mentioned appearances are not identical with those described by Renaut as præpustulation. The destruction of central groups of cells in some interpapillary rete cones, described by Gaucher in connection herewith, was described long ago by v. Basch and myself, in our work on the anatomy of the variolous process (1863).

Perhaps the fact of the matter is, that the vesicular transformation of the cells and their destruction in true pustular formation are observed less readily because they are concealed by the progressive change of the epidermis cells in the interior of the efflorescence into a network ; but that it is distinctly recognizable in the skin *between* the pustules or upon the entire surface of the skin, if instead of cirumscribed spots of suppuration only a *diffuse* inflmmatory swelling and exudation develop, as occurs occasionally in superficial inflammatory processes upon the skin.

Something may yet be said at this time concerning the peculiarities presented by some forms of efflorescence—in the first place wheals. These present anatomically no other appearances beyond the well-known ones of inflammation in the first stages, viz., hyperæmia and inflammatory œdema. But we must emphasize the fact that œdema plays an essentially prominent part in urticaria, and that it evidently arises from spasm in some vascular districts and paralysis in others, *i. e.*, as an angioneurotic œdema. By this means alone is the external appearance of wheals and the occurrence of alternate pale and red parts around and under the œdematous swellings (the wheals) essentially influenced. The disappearance of the wheals without residua shows that only slighter grades of inflammatory congestion occur.

Finally we must refer to the histological appearances in certain forms of nodules and pustules which develop from follicles or preferably from the tissues surrounding them (acne and sycosis).

In acne and sycosis, perifolliculitis is always present (dilatation of the vessels and cellular infiltration of the corium in the vicinity of the sebaceous glands or the hair follicles, and swelling of the epidermis cells above them, with elongation of the prickles

[1] Ann. de Derm., 1881.

and appearance of wandering cells in the rete (Barthélemy[1]). In addition, inflammation and abscess formation in the interior of the glands have been described, and by all observers, atrophy of the sheath of the hair with separation of the latter; Barthélemy also describes onion-like bodies in the epidermis (section of atrophic excretory ducts of hair-follicles).

The differences of opinion depend upon the fact that some (Kœbner) regard as the primary event in sycosis, the process in the interior (folliculitis barbæ), others (Robinson [2]) regard the perifolliculitis as primary, the atrophy within the hair-follicles as secondary; while Kaposi looks upon the interior of the hair-follicles as the starting-point in acne as well as in sycosis.

My examinations lead me to believe that the morbid irritant may come into play in two ways in both processes: first, primarily in the vascular district around the glandular bodies, so that a perifolliculitis develops in this instance at the start and runs its course as such with the formation of nodules or even abscesses.

Or secondarily, in the interior of the glandular bodies or hair-follicles, inasmuch as a morbid process of growth or secretion of a mechanical or other kind (parasitical) forms the primary process in the enchyma cells of the sebaceous glands, or in the root sheaths of the hair. In acne, occlusion (comedo formation) of the excretory ducts then occurs with formation of abscess in the interior of the glands, and finally perifolliculitis.

In sycosis the disease of the root sheaths, which has developed in this manner, may be followed by death of the hair shaft, and by a spread of the process outwards into the connective-tissue portion of the hair-follicle and perifolliculitis. In this case, accordingly, the perifolliculitis is a secondary process. It will not be proper to separate these latter forms (retention forms, Virchow) from the purely inflammatory ones, because transitions always occur.

### *b.* THE MORE DEEPLY SPREADING INFLAMMATIONS OF THE SKIN.

We have to deal here, not with the action of irritants of a different nature from those which produce erythema, etc., but merely with a point d'appui which is situated more deeply or extends more deeply into the distribution of the larger vascular trunks of the corium.

In order to render the difference clear, we will consider, for example, the effect exerted on the one hand by abnormal temperature; on the other, by animal parasites, according as they act with greater or less intensity, and according as they are applied to the healthy skin or to that in which nutrition and circulation have been morbidly changed. We will find that moderate elevation of temperature produces an erythema which occasionally progresses to the formation of nodules or vesicles, or superficial excoriation of the skin, but terminates then by the formation of a new horny layer over the intact corium. This process corresponds, evidently, to superficial dermatitis. But if the intensity of the heat assumes greater proportions or is allowed to act for a longer time, symptoms of destruction of the horny layer occur, or incomplete stasis of the circulation in the corium, or, finally, if the action is so violent that congestive phenomena are not produced at all, necrosis of the tissues occurs at once, with destruction of the papillary body, even of the entire corium as deep as the subcutaneous connective tissue, *i. e.*, effects such as are observed in the well-known three stages of burns. This also hold good with regard to the action of parasitic animals upon the skin.

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[1] Ann. de Derm., 1881.

[2] New York Med. Journ., 1877.

The erosions which are produced by lice (entomoses) or by the itch parasite may be termed superficial inflammations of the skin, although we are well aware that the lesion of continuity alone does not suffice to produce an inflammatory condition of the skin; otherwise every prick of a needle would produce the same effect as the bite of a flea. It may be stated in passing that we have to deal, accordingly, even in the stigmatoses (as I call those superficial inflammations of the skin which begin with an erosion) with the introduction beneath the horny layer of the epidermis of an irritating substance arising in the animal organism. An analogous effect develops in the cutaneous and subcutaneous connective tissue in those cases in which an irritant which acts at one point, and is at the same time vigorous, reaches the depth of the skin from the outside, for example from the prick of pulex, œstrus, filaria medinensis, or in which the direct point d'appui of such an irritant, which is present in the body, is furnished in the manner indicated and at the proper depth.

We will find that in burns, the inflammatory phenomena fall into the background so much the more in comparison with the necrobiotic processes the deeper the burn has acted. But so long as mortification of the cutis is not present, the inflammatory symptoms are observed as in eczema, while the epidermis, as a rule, constitutes a mortified shrunken layer, which is separated from the papillæ or, like the papillary bodies, is filled with closely approximated cells and nuclei, and no longer presents a distinct lower boundary. Occasionally the lumen of some of the larger vessels are surrounded by young cells and filled with blackish, coherent contents, while other adjacent vessels still present a distinct lumen. In burns of the third grade, nothing can be seen either of exudation cells or of serous distention of the tissues, but the entire corium and the subcutaneous tissue are traversed by blackish, firm bands, between which are visible the firm meshes of the former connective-tissue network, containing crumbling masses of destroyed fat-tissue and other detritus.

The anatomical conditions in circumscribed phlegmons, viz., furuncles, carbuncles, Aleppo and Biskra boils, and splenic fever boils, may be gathered in brief from the following appearances in furuncles:

Upon a vertical section through a crusted furuncle as large as a pea, the epidermis was found converted into an opaque, readily detached mass, beneath which was an apparently structureless mass, composed of granular detritus, the remains of elastic fibres, and fat-granules, which occupied the position of the former papillary body; beneath this, with a flat surface superiorly, was a tissue infiltrated with exudation corpuscles, the meshes being formed of bands of connective tissue and elastic fibres. The sebaceous glands and coils of the sweat-glands were intact deeper down, but, like the adipose cells, partially covered with cellular infiltration.

### THE INFLAMMATORY NUTRITIVE DISTURBANCE OF THE SKIN IN ITS RELATION TO VENOUS-LYMPHATIC STASIS. CHRONIC INFLAMMATION OF THE SKIN. TERMINATIONS OF INFLAMMATION OF THE SKIN.

We must now point to the fact that during the further course of superficial as well as of deep-seated inflammations of the skin, certain changes may develop in the tissues themselves, which change essentially the conditions of the return flow of blood, of lymphatic absorption, and of the lymph current in the diseased skin. These changes may arise from general conditions inherent in nutrition or may be produced solely by the inflammatory process in the skin.

The latter condition may be brought about by a functional or anatomical disturbance of circulation which may occur in cardiac disease, as well as when nutrition is enfeebled from any other cause, in cachexiæ from dyscrasia, in short in all those processes which depend upon diminished energy of the blood-pumping machine itself or upon a functional disturbance in the conducting pipes. Under certain circumstances, however, the same causes may exercise the same effects merely upon certain systems of the body or upon

certain regions which are predisposed thereto on account of their greater distance from the heart or of an unfavorable construction of their local venous and lymphatic plexuses, perhaps also of the local innervation.

Examples of the latter are the well-known stases in the lower limbs of females who have borne several children, or that condition which is termed acne rosacea of the face, etc.

We must also regard, as a further example, the local circulatory disturbance left over after superficial and also after deeply spreading inflammations of the skin, and which constitutes a transition to so-called chronic inflammations of the skin.

We have to deal, therefore, essentially with two conditions: either with a pre-existing venous disturbance or with a passive hyperæmia produced by an acute inflammation of the skin. We can bring these two conditions into closer relations if we assume that an active fluxion is added to the pre-existing disturbance, that an inflammatory irritant acts upon a part of the skin which is in a state of passive congestion. The differerence between both cases evidently lies in the question of priority.

We now have to settle the following points:

1. What produces the venous stasis itself, and what relation does it bear to inflammation of the skin? And further,

2. What results follow the combination of both factors in one or the other series of priority?

Experiments have shown that incomplete obstruction of the venous return flow uniformly produces a diminution of the rapidity of the current and coldness of the parts, then transudation of serum, either colorless or (in man) tinged with hæmatin, and finally, the passage of red blood-globules through the walls of the capillaries and small veins, the latter being recognized by numerous, dark red, punctate extravasations chiefly in the neighborhood of the ligature.

In the integument of the human arm the process in general results in the irregular propagation of the incomplete circulatory obstruction, produced by ligature of the veins, from the point of ligature gradually to the various capillary districts of the integument. The optical expression of this stasis is cyanosis. If the stasis continues for some time, the blood plasma passes through the walls of the capillaries, perhaps also of the smaller veins, but at first in very slight amount, so that the size of the limb is not strikingly increased. Diapedesis now begins; hemorrhages as large as the point of a pin develop, most numerous in the neighborhood of the point of ligature.

Around these ecchymoses, the blood plasma, which transuded at the same time, or even earlier, assumes a reddish color.

The vermilion spots, which develop below a ligature which has been applied for some time, are due to admixture of hæmoglobin with the blood plasma, and constitute a transition from serous transudation to the exit of red blood-globules in substance. Between these are noticed white spots, which are produced evidently by the irregular filling of the capillary districts with blood, in consequence of the incomplete stasis of the venous return flow.

These are the phenomena produced by ligature of the veins or stasis upon the human integument, and within a few minutes after the occurrence of the obstruction. If the latter is removed, in a short time all the results of the stasis disappear.

The question now arises, what happens when the stasis persists for a longer period?

In man, experimentation in this regard cannot pass beyond certain boundaries, but

we have sufficient knowledge on this point from experiments on animals, and morbid processes in man.

Experiments have shown that the occlusion of the venous return flow, *a*, when it has continued too long, and is not relieved, finally results in complete cessation of the circulation and necrosis; *b*, when it is long-continued, but is relieved before necrosis can occur, produces acute inflammation, not that the stasis passes into inflammation, but that it acts as a vigorous inflammatory irritant; *c*, when it is relieved early, produces no further phenomena than the above-mentioned œdema and temporary cyanosis, perhaps here and there a few ecchymoses.

As in animals, similar results, from a clinical standpoint, are found with regard to venous stasis in man and its relations to inflammation. Venous stasis in a circumscribed territory, whether produced purposely or arising spontaneously, causes cyanosis, œdema, exudation of hæmatin and red globules, but not of white globules; it has nothing in common, therefore, with the inflammatory change in the walls of the vessels. As in animals, however, it is capable of producing inflammation when it has persisted for a longer period, and is then relieved.

The process just described is, however, less important with regard to the integument than the other case, viz., an incomplete stasis of long duration, such as is observed in general cachectic conditions, and in unfavorable local circulatory conditions.

My experiments have taught that the purely inflammatory phenomena which external irritants produce under such circumstances are usually less marked, and that the formation of pus occurs more slowly, but that the exudation of serous and bloody fluid, furthermore the formation of free ecchymoses, are more frequent; that an inflammatory granulation occurs with greater difficulty; that the entire tissue presents a livid infiltration and dark blue areolæ which cannot be made to disappear entirely upon pressure, and in which the elevation of temperature is less distinctly marked; but finally, that the inflammatory process rapidly terminates in necrosis.

These appearances are found in acne rosacea, in ulcers with a varicose foundation (ulcers of the foot), in eczema under such conditions, etc.

The phenomena of inflammation are thus, on the whole, concealed to a certain extent by incomplete stasis, they occur less distinctly and rapidly.

On the other hand, when inflammation is already present, the symptoms peculiar to stasis (cyanosis, œdema, exudation of hæmatin and ecchymoses) appear so much more distinctly after subsequent venous stasis, the more marked the inflammatory change has been.

Ligature experiments which I have made upon cases of scarlatina, etc., have shown that the vermilion spots around the ecchymoses occur most certainly and intensely in those positions in which the most marked erythema is situated.

From this fact and from experiments upon frogs and rabbits, it appears that, in moderate grades of inflammation, incomplete stasis is followed by slight phenomena (escape of serum and hæmatin); in higher grades, especially those associated with suppuration, by the enormous escape of blood-globules into the tissue of the cutis. But the stasis is by no means capable of producing more marked suppuration in an inflamed part which is already suppurating. There is no doubt, therefore, that venous stasis in itself has nothing to do with inflammation, *i. e.*, with the change in the walls of the vessels assumed therein. There is no doubt, on the other hand, that the stasis may act like another irritant, that phenomena of inflammation may be developed by stasis after some time.

These facts enable us to understand that inflammatory processes under disordered circulatory conditions, although not without a distinct difference from ordinary inflammations, nevertheless run their course without any change in the main type of the process.

With the aid of these physiologico-pathological data it will not be difficult to paint a picture of that chronic inflammation of the skin, of a superficial and deep-seated character, which so often prevents the resolution of the pure inflammatory process, and often leads to unfavorable terminations.

Previously, however, we must again recur to inflammation of the skin itself, and to some forms which constitute a transition from pure inflammations to the chronic forms of inflammation, developing at a later period during the cessation of inflammation. We will call them stasis-inflammations of the skin, and separate them into stasis-catarrhs and stasis-phlegmons, according as they occur superficially or are more deeply seated. To the former belong ecthyma and the superficial ulceration of the skin, to the latter, phlebitis and lymphangioitis cutis, and erysipelas.

The examination of ecthyma pustules upon the leg showed the well-known appearances of an ulcerated pustule: infiltration of the base of pustule, of the tissue of the corium beneath the pustule, and in the immediate neighborhood, with dense masses of cells and granular detritus giving rise to an obliteration of the boundary between the epidermis and corium.

In such cases the differentiation from pure forms of dermatitis lies in the fact that the termination in necrosis of the base, which is confined to the pustule itself, is caused by the unfavorable nutritive conditions of this base, while this termination is exceptional in other forms of pustular formations; for example, in small-pox, pustular eczema due to croton oil, etc.

This corresponds to the definition of ecthyma originally given by Willan:

"An eruption of large phlyzacical (*i. e.*, surrounded by a zone) pustules, each of which is situated on a hard elevated base, and terminates in the formation of a thick, hard, greenish, or dark-colored crust. They are separate, distributed over a slight area, and are not contagious."

Analogous to the superficial forms here described, certain transition forms between congestion and stasis also occur deep in the skin, viz., phlebitis and lymphangioitis of the skin and erysipelas, and in this complication of superficial arterial congestion with marked stasis symptoms more deeply, the direct relationship is made evident between these phlegmonous processes and the pure stasis diseases, in which arterial congestion is entirely absent or plays a subordinate or accidental part.

Erysipelas furnishes us with a typical picture of the stasis phlegmons.

Here the vessels extending into the subcutaneous tissue are filled with blood; the tissue of the cutis soaked with serum, its meshes dilated and filled with white blood-globules which are especially profuse around the deep venous trunks and almost conceal them, but are also accumulated between the fat-cells and around the sudoriparous glands. I have found the lumina of the larger lymphatic vessels gaping; their distention with lymph-corpuscles was not demonstrable. Renaut found the panniculus adiposus inflamed and swollen.

In the papillary layer of the corium, the cellular infiltration is also present, but less dense than lower down. In the cases of the development of vesicles, the corresponding changes may be observed as in the formation of vesicles in general.

The cellular infiltration and inflammatory œdema of erysipelas disappear as completely in those portions of skin which return to the normal, as they do in superficial inflammatory processes.

It is evident from the anatomical appearances and clinical signs that in true erysipelas we always have to deal with an affection of the lymphatic vessels (and blood-vessels) deep down and extending into the subcutaneous tissue. While a rosy redness is present in superficial erythema, erysipelatous redness shows a peculiar bluish-red glistening with a yellowish border, corresponding to a congestion deep down in the skin covered by a thicker layer of tissue, and the œdematous swelling corresponding to the serous infiltration of the connective tissue in the depth of the skin.

Erysipelas must be regarded probably as a capillary lymphangioitis and capillary phlebitis, which can only be distinguished by its superficial expansion from the band-shaped redness of phlebitis and lymphangioitis of larger vessels. As a matter of course, the process results secondarily in an affection of the upper layers of the skin, the papillary layers of the cutis, and the epidermis.

There is much to be said in favor of the view that the capillary lymphangitis and phlebitis, which give rise to erysipelas, must be attributed to infection by a microparasite. Very recently, Fehleisen produced erysipelas directly in man by the inoculation of cocci cultivated from erysipelatous skin (Verh. d. Würzburger phys.-med. Ges., 1882). The anatomical and clinical process in erysipelas may, indeed, be explained very plausibly in this manner.

We may now conclude the nosology of chronic inflammation of the skin. As previously explained, we have to deal with a case in which stasis is induced and gradually superadded to a previous inflammatory affection. It is evident from experiment that these conditions of stasis should not be regarded directly as inflammatory processes, but merely as incomplete phenomena of stasis secondarily caused by the latter, that accordingly the phenomena of the real inflammatory process actually have been extinguished in them. In the human skin the following changes occur as evidences of this improperly termed chronic inflammation, which should be really called "chronic stasis in consequence of previous inflammation."

1. The phenomena of inflammatory œdema give place to the œdema of stasis, *i. e.*, the escape of blood-serum from the veins. At the same time, the connective-tissue cells present in the connective tissue of the skin begin to grow and proliferate, and in their further course present the various stages of development into fibrous and elastic networks and bands, new formed blood-vessels, etc.

The clinical signs of this condition are: infiltration and thickening of the skin, at first with purely serous contents which may be forced away partially upon pressure; a dark-red, gradually passing more and more into a bluish tint, of the surface upon which a disturbance develops secondarily in the formation of new horny layers, inasmuch as a slow, branny desquamation occurs. This is the typical highest stage of chronic superficial inflammation of the skin, the so-called chronic eczema. As a rule, however, the process terminates in a return to the normal, although often not until after a long duration of the stasis.

2. Under specially unfavorable circumstances, such cases also may result in further degeneration, in those necrobiotic processes which occur ordinarily only as terminations of phlegmonous inflammations. Thus, chronic eczema terminates occasionally in sclerosis of the connective tissue of the skin, together with stasis processes in the sanguineous and lymphatic capillaries, *i. e.*, in pachydermie.

The pustules of acne and variola end occasionally in the formation of ulcers and cicatrices, while these terminations constitute the rule in deeply spreading phlegmons. Here they appear either as necrobiosis with softening and necrosis of the tissues in layers (in phlegmons affecting the layers of the skin, such as burns and congelation), or in

the form of circumscribed degenerative processes with ulceration and gangrenous degeneration (in localized phlegmons: furuncles, anthrax, and the like).

Under the same conditions, as in other regions, fatty and amyloid degeneration, mucoid metamorphosis, cheesy degeneration, and calcification play their part in the integument.

### THE INFLAMMATORY NUTRITIVE DISTURBANCE OF THE SKIN IN ITS RELATION TO ANGIONEUROTIC AND NEURITIC PROCESSES.

It is now incumbent upon us to examine the large number of inflammatory processes occurring upon the skin, with regard to their connection with the entire organism, and with morbid changes in the latter. Attention has been called in various places to the close connection between inflammation of the skin and the condition of the entire organism, to the fact that many local fluxions are effected directly through the agency of other organs without an external irritant, and also to the reaction of inflammations of the skin upon the entire organism, its nutrition and diseases.

But apart from this general causal nexus, there are other special factors which are so important that they powerfully influence the course, even the character of such inflammations. This will be made clear by a comparison of a few distinct types of skin disease with one another, for example, acute eczema produced by croton oil, the variola eruption, and herpes zoster.

In the beginning, all three forms present hyperæmia of the skin, followed by the formation of nodules, vesicles, and pustules. As is well known, eczema nodules may pass into vesicles, and the latter may be converted into pustules; this is the case in variola, and in herpes zoster, a few vesicles develop into pustules.

The anatomical picture is always that of the inflammatory efflorescence, starting from the papillary body and its blood-vessels, with subsequent changes in the epidermis, swelling and formation of a network, inclosure of serous, then of purulent contents in their centre, finally drying of these contents, and development of new epidermis above the papillary border.

Despite the fact that the clinical course of the inflammatory process upon the skin develops under all circumstances according to the same anatomical and nosological pattern, nevertheless a separation of the three conceptions of the disease is afforded by other factors which do not depend upon the local effect of the inflammation.

If we retain the above illustrations, we will find that an intense acute eczema, produced, for example, by the prolonged action of croton oil, allows the local action of the irritant upon the structure of the skin to appear most markedly and exclusively; marked erythema, extensive and diffuse serous infiltration of the diseased parts, rapid formation of vesicles, occasionally leading quickly to excoriations of the upper layers of the skin, gradual transition into desquamation and recovery. On the other hand, we find in severe cases of variola, a typical, but slightly variable period of incubation, characterized by general symptoms of the disease, without any localization, then a prodromal febrile stage, and a diffuse prodromal erythema which is entirely independent of the later position of the efflorescences; tendency to ecchymoses (variola hæmorrhagica); development and progress of the individual pocks, not alone according to the types of inflammatory efflorescence formation, but also with a typical duration of the individual phases of development, and without diffuse serous infiltration of the skin between the pustules, as in eczema; finally termination of the process with the drying up of the individual pustules,

or formation of ulcers and cicatrization without persistence of a chronic inflammatory process, while this is not infrequently the case in eczema.

The peculiarity of this course is connected evidently with an influence foreign to the inflammatory process of the first variety, the point of attack of which must be sought in the circulation of the blood, in the walls of the blood-vessels, and the blood itself. The mere progress of the process in the integument is alone sufficient to show the difference between the variola process and that of acute eczema, despite the identity of the purely inflammatory processes.

If we pass to the third one of the illustrations chosen, to the so-called herpes zoster, we will find in it:

Frequent neuralgic pains, as the prodromal stage, in the distribution of the tegumentary branches of a certain nerve, then the coincident occurrence of a series of inflammatory nodules upon a hyperæmic basis, which soon pass into vesicles, partly also into pustules; then development and progress of one or more other groups of vesicles according to the same type and the same course, always along the branches of some nerve; finally, after the termination of the local inflammation, occasional continuance of the neuralgia. These forms of inflammation of the skin always depend upon a neuritis of the nerve-trunk, or an affection of its ganglion.

If we compare the three morbid processes just mentioned, we will arrive at the following conclusions:

1. The process of inflammation in the skin runs its course according to a pathological schema which agrees with the general symptomatology of the inflammation of organs in general. Hereafter we will describe this process as simple inflammatory process of the skin (dermatitis simplex).

2. This inflammatory process constitutes a nosological entity which cannot be destroyed either by the predominance of one or the other symptom of inflammation, or by the degree of development which the process reaches in individual cases.

3. In addition, there are inflammations of the skin the development, course, and terminations of which correspond to the nosological schema of this inflammation, but in which other phenomena are vividly presented, the origin of which cannot be found among purely inflammatory factors, or only when the latter have increased to such an extent as does not seem capable of furthering the inflammatory process. This occurs in smallpox and zoster. These forms of inflammation may be termed partly angioneurotic, partly neuritic dermatoses, according to the character of the most prominent factor. Their difference from simple inflammations of the skin resides in the fact that the character of the general constitutional influence is such that it essentially changes the form of the inflammatory process in the skin. And this alone is the reason why a clinical separation of these three forms of inflammatory dermatoses appeared advisable.

*a.* Changes in vascular tonus always occur in congestions produced by inflammatory irritants, and cannot develop without active or passive stimulation of the muscular coat of the vessels within and around the inflamed part. And furthermore as a consequence of, and during the course of the inflammatory process, changes in the vascular tonus readily develop and may find an expression in chronic disturbances of the circulation and absorption. But the change of vascular tonus, to which reference is made here, manifests itself first by its relative independence of the inflammatory process; secondly, by its direct connection with the etiological factors which have given rise to it, and thirdly, by the extension of its influence beyond the point of action of the irritant. The etiological factor in all diseases of the skin belonging to this category bears the peculiar

character of an agent which acts toxically upon nutrition. This implies at the same time that we have to deal with an irritant action which, starting from a certain central point, radiates in all directions, or, at least, which recurs and repeatedly attacks the periphery.

All the affections of the skin belonging in this category correspond to the following nosological conception: a peculiar irritant acting upon any part of the organism whatsoever, influences a centre of vascular nerves, either directly or in a reflex manner, so that a change occurs in the tonus of the vascular branches belonging to it. Whether this "centre" is identical with one of the large vaso-motor centres in the medulla oblongata or spinal cord, or must be sought in the small ganglionic nerve elements of the walls of the vessels themselves, can be determined in general with great difficulty.

Equally difficult is the solution of the question whether we have to deal with phenomena of irritation or paralysis. We cannot doubt that vaso-dilators as well as vaso-constrictors are active in the walls of the blood-vessels of the skin, and that an irritation of the dilators may thus effect the same object as paralysis of the constrictors, viz., dilatation of the vessels. The reverse holds true concerning contraction of the vessels. As the first series appears to correspond more to the picture of arterial active fluxion, the second series to that of passive congestion, and at the same time bears the stamp of a spasmodic contraction of parts of the vessels, such as we find especially marked in urticaria, it does not seem to be too bold an hypothesis to state that we have to deal in the first series with an irritant effect upon the dilators or paralysis of the constrictors, in the second series with irritation of the constrictors or paralysis of the dilators. Dilatation and contraction of the lumina of the vessels may be observed at the same time in different parts of the same vessels, one form not infrequently as a sequel of the other. It should also be taken into consideration that the contractility of the capillaries can scarcely be doubted.

Among the angioneurotic inflammations of the skin, I place the acute exanthemata in the first rank.

In their essence these diseases are poisons of general nutrition. Their symptoms appear in the most varied tissues and organs, also upon the integument. In the latter the effects are manifested always in the form of a peripheral angioneurosis, as dilatation of the vessels and hyperæmia of larger or smaller portions of the skin. Under the influence of the general febrile condition and the continuance of this change of tonus in the walls of the vessels, those changes in the latter begin which are produced otherwise by inflammatory irritants of a different kind.

In this manner local inflammations of the skin are begun, the further course of which is variable. In some acute exanthemata the inflammatory change is also a superficial catarrhal one and is restricted either to the development of erythema, or an inflammatory exudation appears more distinctly with formation of papules and patches of pigment, or, in a third series, the formation of vesicles and pustules occurs, but always retains the character of superficial inflammation.

The appearances in scarlatina are, indeed, exactly the same as in the roseola of typhoid fever or cholera: at first, simple hyperæmia without any change in the tissue of the corium; further, in some parts of the skin, occasional accumulation of red blood-globules, in certain places ecchymoses and suffusion with blood pigment (yellowish color of the skin) which latter phenomena may be attributed to the general morbid character of these infectious diseases. However, the inflammatory œdematous swelling of the skin is due to the inflammation of the skin proper, unless it has been produced by an early renal affection.

A greater implication of the follicles of the skin is evident in measles, and is manifested clinically by the formation of nodules at the site of the openings, microscopically by abundant accumulations of cells around the excretory ducts. We are justified in regarding the morbilli process as spreading more deeply in the integument than that of scarlatina, and this is further substantiated by the fact that distinct dark pigmentation remains behind after the morbilli spots and nodules have grown pale, and only a yellowish color remains after scarlatina. But that both processes play merely the part of catarrh of the skin is shown by the appearances upon the mucous membrane of the larynx and pharynx, which merit evidently the most complete analogy with the external integument. The increased secretion of the mucous membranes corresponds also to the desquamation after measles and scarlatina.

It is different in a second series of the infectious angioneuroses, in which deep-seated abscess formations of a diphtheritic, or, at least, phlegmonous character occur, and evidently bear the character of specific efflorescences (pustules of variola, glanders, and splenic fever) in connection with the continued circulation of the specific virus. The anatomical conditions in these forms of inflammation have been described above in their main features, and we may, therefore, regard them as known.

The prominence of the angioneurotic disorder in the acute exanthemata is evinced still more clearly by the undeniable relationship between them and the toxic angioneuroses of the skin, to which belong, in the first rank, the so-called medicinal exanthemata. Here also the symptoms of a vaso-motor neurosis are not alone prominent in the beginning, but apparently are often the sole ones until the termination of the process. In other cases they are associated with nutritive disturbances of the skin which bear mainly the character of inflammatory congestion in the most varied grades.

The apparent relationship of certain of these diseases with infectious exanthemata is so great that mistakes arise not infrequently (scarlatina and quinine eruption, between measles and certain maculo-papular eruptions produced by resinous substances, such as balsam of copaiba, etc.).

And finally a third group exists which I will call the essential angioneuroses of the skin. The cause of the diseases belonging to this class is to be regarded as a general increased sensitiveness of the vaso-motor nerves to irritants of all kinds, which appear either in a persistent or cyclically recurring manner, and the expression of which may be regarded as the tendency of the skin to respond to the slightest contact with dilatation or spasm of the vessels, in the beginning only at the point of irritation, but soon in a larger zone around the latter.

Upon such an integument sharply defined erythema or even distinct wheals with a white, anæmic border develop at every contact; they disappear only after a long time, and after they have spread upon the surface for some time.

This phenomenon is merely a morbid increase of the vaso-motor sensitiveness of the skin which is present also in the healthy condition.

This condition of increased vaso-motor sensitiveness is to be regarded as the real pathological change in the forms of disease belonging to this category, but which requires for its development either an increase of the cause of the disease itself, or an accidental irritant not standing in direct connection with it.

While, therefore, in the infectious and toxic angioneuroses of the integument, the poison circulating in the organism seems to be the excitant both of the central vaso-motor irritative conditions and those located in the skin, and the angioneurosis disappears with its disappearance, the general vaso-motor disturbance in diseases of the third

group is a persistent or cyclically recurring one. The addition of an internal or external irritant, however, is necessary to the development of the skin affection. It is, therefore, wrong to call these diseases purely vaso-motor. Not the inflammatory disturbance, but the tendency of the skin to respond with such a change to irritants of the most varied and often trifling character must be regarded as the real disease; this distinguishes these nutritive disturbances from the inflammations produced by inflammatory irritants upon normal skin.

Only when looked at in this manner does the vaso-motor hypothesis agree with the facts; the catchword "angioneurosis" alone, as is so fashionable at the present time, is in no respect sufficient.

*b.* The second category of inflammations of the skin which branch off from the simple forms of dermatitis, is that of the neuritic inflammations, *i. e.*, those produced by diseases of the nerve trunks or centres.

These affections, which are often termed "trophoneuroses of the skin," have not been excluded hitherto by dermatologists from the category of dermatitides in general. But they require an independent position, because the etiological factor has an essential influence upon the symptoms and course of the disease. Here stress need merely be laid upon the fact that I prefer the term "neuritic dermatoses," to that of "trophoneuroses," because,

1. The relation of the trophic processes in the skin to their innervation in general has been cleared up to but a slight extent from the physiological side;

2. Because the separation of this group was adopted by me merely for the special reason that a morbid process in the nerves can be constantly determined objectively as the causal factor.

Such neuritides may give rise to nutritive disturbances of the skin, which differ in their course from ordinary inflammations. The inflammation either appears and runs its course in a strictly cyclical form as in herpes zoster, or, with a less strict type of course, the inflammatory processes present a great variety of form and grouping (the neuritic erythanthems with their development of nodules, vesicles, pustules, and wheals), finally, thirdly, by their tendency to further nutritive disturbances as, for example, to disturbances of absorption (œdema) and quite often to a diminution (atrophy) or even complete extinction (necrosis) of the nutrition of certain portions of the skin. To the latter category belong neuritic lioderma (glossy skin of American authors), alopecia neuritica, leucoderma neuritica (morphœa, vitiligo), decubitus acutus of Samuel, etc.

The classical picture of dermatitis neuritica of a cyclical course is furnished by herpes zoster, the trophic tegumentary change in which corresponds to the distribution of sensory nerve trunks.

There are so many transitions between the symptoms of typical herpes zoster and those of an anomaly of development, for example, of the hairs in consequence of neuritic processes, that their complete description must be reserved for special consideration. I include all these forms—because they are always situated upon an inflamed, reddened base, and present the most different and variable efflorescences—under the same generic term erythanthema, but with the specific limitation "neuriticum" in order to distinguish it from the other variety

The symptomatology of the non-cyclical, neuritic nutritive disturbances of the skin with an atrophic character is furnished by glossy skin, an affection which occurs occasionally after injuries of nerves, but only when no complete solution of continuity in the nerve has occurred. It begins with erythema, which gives way to a smooth shining appearance of the thinned integument.

Finally, the purely necrotic process in the integument in consequence of neuritis may be studied most clearly in the so-called acute decubitus—a redness with formation of vesicles which occur suddenly upon the paralyzed or anæsthetic side in diseases of the brain and spinal cord, almost always in the sacral region without any demonstrable pressure, and rapidly passes into necrosis.

## REVIEW OF THE INDIVIDUAL FORMS OF INFLAMMATION OF THE SKIN.

If we now review the pathological processes in inflammation of the skin in general and compare with them the symptomatology and anatomical appearances of the individual forms of dermatitis, we will find

1. The most superficial and mildest forms, the temporary erythemata produced by mild irritants, such as erythema solare and the like, and erythema of longer duration but slight intensity, like erythema neonatorum.

2. A somewhat more prolonged duration of the erythema and the occurrence of more or less intense œdema are found—

*a.* in various acute infectious diseases: measles and scarlatina, the prodromal rashes of variola, furthermore in the roseola of typhus and cholera. We have to deal here with erythemas which are impressed with the character of a severe general disease and, upon the skin, with the peculiar character of the angioneuroses, but which, if the tegumentary processes per se are considered, can only be interpreted as simple hyperæmia with more or less inflammatory œdema.

*b.* In the various forms of development of wheals (erythema papulatum, pomphosis, urticaria, cnidosis). Here also we have to deal with erythema associated with inflammatory œdema, but under certain peculiar modifications, viz., the combination with spasm of individual vascular tracts, which occurs most constantly in true angioneuroses, but also accessorily in simple inflammations and in inflammations of the skin produced by neuritis. Erythema papulatum and urticaria in toxic and the so-called essential angioneuroses of the skin, as well as in neuritic dermatoses, depend upon this process, which really constitutes merely a symptom of inflammation, but no real independent disease.

3. The complete development of the inflammatory process may be learned in various morbid processes which we may attribute, partly with entire certainty, partly with great probability, to an intensified form of the inflammatory irritant and its vigorous action.

Here may be included:

*a.* Some of the series of erosive superficial inflammations, for example, the efflorescences which are produced by the acarus; furthermore, the forms of diffuse superficial inflammations (eczema) and of follicular superficial inflammations (miliaria, acne, sycosis);

*b.* The final variola exanthem.

*c.* A series of inflammatory superficial affections of the skin, which are distinguished by the manifold character of their efflorescence development from simple hyperæmia to the most fully developed pustular formation: the erythanthemata eruptions upon an erythematous basis, to which belong, among the series of the angioneuroses of the skin, the "polymorphous" erythemas of Hebra and those produced by drugs (toxic), and, finally, neuritic skin diseases of an inflammatory nature.

At a later period we will have an opportunity of noting that the variability of the form as well as certain peculiarities of the development and course of the primary lesion in all

these cases do not arise from the mere inflammatory irritants themselves, but from other nosological factors. From an anatomo-pathological standpoint, however, there is no difference between these and other inflammations of the skin of a superficial character.

*d.* Certain inflammatory dermatoses, which are called "irritative forms" (Virchow) of dyscrasic processes, such as syphilis, scrofula, etc.; they appear as maculæ, nodules, vesicles, pustules.

The processes giving rise to them are of such a wide-spreading character that they are no longer restricted, in severe cases, to the production of superficial dermatitides, but also extend their action into the deeper parts of the skin and give rise to furuncular, ulcerative, and destructive forms, the main pathological sites of which are the deeper layers of the corium and the subcutaneous tissue. And, finally, all these irritative processes are associated with further processes which can scarcely be termed inflammatory, but rather developmental anomalies of the connective-tissue elements, as granulation-like new formations of an embryonal type, and which impart to syphilis, scrofula, and other affections their peculiar type. We were compelled to mention them at this time because that part of their symptoms, which is called irritative, presents in many cases perfectly sharp pictures of the inflammatory process. Too much stress cannot be laid upon the fact that it is not the cellular infiltration per se which constitutes the essence of one or the other process, viz., inflammation or granulation, but that the real feature is the anatomo-pathological course of this cellular infiltration, which is soon absorbed in inflammatory processes of a superficial character, in more deeply seated ones assumes necrobiotic terminations (degeneration, ulceration, destruction), but, in granulation processes, continues for some time as a more persistent infiltration without further development into higher forms of tissue but also without rapid retrogression.

If we associate all those forms of inflammation of the skin in which the inflammatory irritant has acted from the start upon the deeper layers of the corium of the subcutaneous connective tissue, *i. e.*, upon the layer of the larger nerve-trunks, the larger lymphatics, and the deeper glandular structures, it becomes evident that the appearances even in these cases differ from the varieties of superficial inflammation of the skin in those anatomical peculiarities alone which are furnished by the deeper anatomical situation. A second essential feature is the fact that, in consequence of the deeper point of attack of the irritant, disturbances in the circulation, venous and lymph stases, occur more readily and furnish a direct transition between certain of the forms of inflammation, belonging to this category and true stases-diseases of the skin; finally, for the same reason, viz., the circulatory disturbance, necrobiosis develops readily and rapidly in these deeply spreading inflammations. This is true of superficial phlegmons (burns, pseudo-erysipelas, or diffuse idiopathic phlegmon of the skin), of localized phlegmons (furuncle, anthrax, carbuncle, etc.), and finally of phlegmons directly complicated with stasis (phlebitis and lymphangioitis of the skin, and erysipelas).

### THE NON-INFLAMMATORY NUTRITIVE DISTURBANCES OF THE SKIN DUE TO INDEPENDENT STASIS-PROCESSES.

There is a series of morbid processes in the skin, in which venoso-lymphatic stasis and the consequent tissue changes appear from the start in a characteristic manner, although they possess no necessary connection with inflammatory irritants or with an inflammatory congestion which inaugurates the disease.

Direct mechanical obstructions to the circulation are the most frequent causes of

such circulatory disturbances, and occasionally inflammatory processes in the walls of the veins and lymphatics (phlebitis, lymphangioitis). It cannot be denied that these diseases of the vessels are followed occasionally by a form of passive inflammatory congestion (erysipelas) and that, on this account, these acute hyperæmic processes are connected directly with the chronic forms of stasis and anomalies of absorption; for example, elephantiasis arabum is thus connected with erysipelas and acute lymphangioitis. But this connection is an etiological, not an essential one.

We know from experiment and experience that, under favorable circumstances, the venoso-lymphatic stasis may act upon the skin as an inflammatory irritant.

If this occurs, it results in the development of true congestive processes, even of an arterial character, of which erysipelas is an illustration. Whether such an irritant action occurs at the same time or later, the real character of the process does not reside in the inflammation, but in the vascular stasis and the anomalies of exudation (transudation) and the tissue changes (sclerosis of the connective tissue, etc.) immediately connected therewith, or finally in the development of a necrotic process (gangrene, etc.); and this is the reason for including such diseases in one group, viz., stasis-dermatoses presenting the characteristics of a passive disturbance of circulation and impaired venoso-lymphatic absorption.

The passive stases of circulation and absorption which characterize diseases of this kind produce, according to their form, partly incomplete, partly complete obstruction of the circulation. As has been shown above, the effects of the former vary according to the degree of stasis and the greater or less implication of the lymphatic apparatus. They are either:

Mere passive (stasis) hyperæmiæ which do not, however, present the vascular change necesssary to inflammatory processes, and must, therefore, be distinguished from inflammatory hyperæmias.

Or they lead to transudation of blood-serum though the walls of the vessels into the surrounding tissues. Pathology applies to these serous effusions the name œdema and recognizes various modifications of it.

To the class of stasis-dermatoses—apart from mere passive (venous) hyperæmias and local ischæmias and also complete stasis-processes with necrosis of the skin, as, for example, local asphyxia, traumatic decubitus, etc.—belong in the main two forms of disease, both of which begin with venoso-lymphatic stasis, and terminate in part in hypertrophy, in part in atrophy. The first form is represented by elephantiasis arabum, or pachydermia, the second by sclerema (scleroderma, scleroma of the skin). It appears to me proper that in this class should be included "myxœdema," first described by Gull as a chronic general œdema with pallor, dryness, atrophy of the skin and mucous membranes, diminution of temperature, and psychical disturbance. According to Ord and others, the œdematous infiltration presents a marked mucoid structure.

It must be reserved for the special nosology to give the clinical symptoms of the other diseases mentioned above. At this place the reasons for giving the above definitions will be briefly stated:

Elephantiasis arabum is not an inflammation of the skin and does not begin as such, but, in the endemic forms which constitute the most typical varieties, with a symptom of stasis, viz., with acute or chronic œdema of the subcutaneous connective tissue, followed by enlargement of the lymphatic glands, occasionally by inflammation of the larger deep veins and lymphatics, then by erysipelas, and finally thickening of the connective-tissue layer underneath and in the skin. The deep inflammatory symptoms which

occur (erysipelas) are not a primary part of the process, but the result of a nutritive disturbance.

Nor is elephantiasis arabum a primary hypertrophy of the skin, a diffuse fibroma in Virchow's sense.

The hypertrophy of the connective-tissue layer is evidently the result of a disturbance of absorption in the tissues of the integument, as is distinctly demonstrable by the typical occurrence of œdema and the increase in thickness of the connective tissue after every relapse of acute phlebitis, lymphangioitis, and erysipelas.

These remarks hold good also with regard to scleremata of the skin. The first symptom of every scleroderma is lymphatic œdema, circumscribed or diffuse swelling of the tegumentary tissues. This condition corresponds clinically to increased tension of the skin, diminished temperature, loss of sensibility. The immediate cause of this change is entirely unknown, but the œdema, which is always present at the onset, places it beyond a doubt that we have to deal with stasis and an anomaly of absorption. On the other hand, all symptoms of phlebitis and capillary lymphangioitis are absent; there is no erysipelas or accumulation of lymph in the tissues, even in those forms which run an acute course (sclerema neonatorum), so that the difference between sclerema and elephantiasis arabum is at once evident.

As opposed to elephantiasis, which always ends in hypertrophy, the termination of all forms of sclerema in atrophy of the connective tissue must be regarded as typical. The majority of the cases observed have been described by authors merely during this last stage.

But sclerema is not a pure atrophy of the skin. It must be distinguished also from the "general atrophy" of Wilson, a probably congenital progressive atrophy of the skin associated with pigmentation and teleangiectases, which I have called essential lioderma.

In its further course, however, the termination of sclerema in atrophy occupies the foreground and its symptomatology finally becomes very similar to that of pure atrophy of the skin.

### HEMORRHAGIC NUTRITIVE DISTURBANCES OF THE SKIN.

In the series of dermopathies last discussed, we found that the point of departure and chief characteristic are the mechanical stases in venous and lymphatic vessels, together with an absence of the inflammatory change in the walls of the vessels. Here, as in inflammatory diseases of the skin, it has often occurred that, in addition to the other phenomena of inflammation or mechanical stasis, an exudation of red blood-globules greater than normal has taken place through the walls of the vessels on account of a simple intensification of the pathological process. This experience offers a transition to a further group of diseases in which the primary inflammatory change in the vascular walls and venoso-lymphatic stases are likewise absent, but the chief feature of which is also the increased passage of red blood-globules through the walls of the vessels.

This group includes in part certain traumatic hemorrhages (ecchymoses) independent of external irritants of the skin, in part those forms (essential hemorrhages) which are connected with general affections or other organic disturbances. They include purpura, morbus maculosus Werlhofii, and scorbutus.

## THE DISTURBANCES OF INNERVATION (IDIONEUROSES) OF THE SKIN.

The term idioneuroses of the skin is applied exclusively to those disturbances of function in the distribution of the cutaneous nerves to which no trophic disorders are peculiar, except that such nutritive disturbances may be associated as secondary processes. These affections are therefore readily distinguished from the neuritic dermatoses, as well as from the angioneuroses. The idioneuroses include sensory as well as motor neuroses.

The sensory neuroses are subdivided into two groups.

Occasionally the sensory disturbance consists of an increase, diminution, or alienation of the normal tactile sensation. The diseases belonging to this category, which are associated usually with central nervous affections, are called hyperæsthesia, anæsthesia, and paræsthesia of the skin.

The neuroses of the second group have nothing to do with sensory impressions from the outside, but merely reflect the impression which the condition of our integument or of individual portions of it *per se,* produce upon consciousness. This form of activity of our consciousness is called "general sensibility," and with regard to the skin "cutaneous general sensibility."

Disturbances of cutaneous general sensation may be presented to consciousness under two forms:

First as sensations of pain. Those changes of the tegumentary nerves which simulate in consciousness the impression of a uniform, constant irritation of a nerve-trunk and its region of distribution, are called neuralgias.

Secondly as the sensation of pruritus. This includes sensations which are interpreted in consciousness as if simultaneous, very slight irritations of the extreme terminal ramifications of the nerves had occurred. Pruritus is evidently closely associated with the sensation of tickling. The term pruritus cutaneus is applied to that disease which manifests itself by violent itching without any other disturbance, *i. e.,* in the form of a pure sensory neurosis.

This constitutes a transition to another sensory neurosis which differs from it only in the simultaneous implication of the muscular fibres of the skin, and represents the second form of diseases of cutaneous general sensibility. This form of disease is known as prurigo.

Pruriginous skin presents all the well-known histological changes found in any cutis which is in a condition of chronic irritation.

Derby and Gay found in the hair follicles and root sheaths such appearances alone as are common to other chronic processes of the skin with or without pruritus and formation of nodules, for example, the papillary out-growth of the root-sheaths and the thickening of the smooth muscular fibres, the arrectores pilorum, which occurs prominently in prurigo, but also in other processes connected with the hair follicles, for example, lichen ruber and lichen scrophulosus.

Thickening of the horny layer above the nodules in prurigo has been noted by all observers. The color of the nodule—if it has not been scratched—is like that of the healthy integument. These facts favor the view that the nodule of prurigo is nothing more than a form of lichen pilaris.

Goose-skin is a constant attendant of prurigo nodules and naturally occurs more markedly than usual when the arrectores are hypertrophic. As goose-skin often is produced suddenly by emotional disturbances or changes of temperature, it is regarded as a spasmodic muscular contraction, and the process which lies at its foundation as a motor neurosis of the skin.

The absence of signs of inflammatory fluxion, the occurrence of pruritus, etc., justify the following conclusion:

Prurigo, like pruritus, is a sensory neurosis of the skin. It differs from the latter in the primary development of nodules, and is characterized anatomically by the hypertrophy of the smooth muscular fibres, physiologically by the coincident goose-skin.

The interpretation of prurigo is rendered clearer by a few additional factors:

First, by the constant occurrence of urticaria (which is eminently a vascular spasm of the skin) in the prurigo of children, *i. e.*, in the first outbreaks of the disease.

Secondly, by the fact that the specific nodular eruption of prurigo is not absent in any case—otherwise the diagnosis is not made—but that there is scarcely a case in which the nodular eruption during one or another attack is either very slight or entirely absent, while the pruritus and eczematous symptoms do not suffer the slightest diminution compared with other attacks.

## THE DEVELOPMENTAL ANOMALIES OF THE SKIN IN GENERAL.

The nutritive disturbances which we have discussed are often followed by more or less permanent changes in the quantity and quality of the tissue elements, as well as in the form of their restitution. The skin furnishes, in this respect, a distinct example in that secondary change of the upper layers of cells which are destitute of vessels, in the form of chronic desquamation often left over after erythematous and eczematous processes.

We will now make use of the illustration just adduced for a few further considerations. Desquamation of the epidermis may also occur in another manner, as in that disease which develops soon after birth and is known as simple ichthyosis (with diffuse desquamation or in slighter grades branny desquamation). In both cases, in desquamation after inflammations and in ichthyosis, we have to deal with an immoderately rapid and profuse restitution of the horny layer which is cast off; in the first case as the remains of a nutritive disturbance, in the second case as the expression of a developmental anomaly of the tissue elements. The latter disease is a primary one, but it resides inherently in the type of tissue development, *i. e.*, in the laws of development of certain tissue elements.

What has been said of ichthyosis, also holds good of acquired diseases.

In like manner, the distinction between nutritive disturbances and developmental anomalies may also be maintained with regard to those tissues which, on account of their anatomical structure, are the direct primary site of the nutritive disturbances, in our case accordingly the corium. In the case of the epidermis, indeed, the nutrition of which depends entirely upon the vascular underlying structures, the distinction depends upon the structure of the latter. If the corium is inflamed, the change in the epidermis must also be regarded as dependent upon the inflammation and is therefore a process belonging to it. But if the corium is normal and the epidermis elements are alone in an abnormal condition, we have to deal merely with an anomaly of development. This is different in regard to the corium, which, having arisen from the mesoblast, includes all forms of connective substance, and therefore appears polymorphous in its deviations of development.

The anomalies of development of the skin, therefore, may be differentiated in two directions, according as they depend upon the anatomical and physiological laws of development of the epithelial or of the connective-tissue layers of the skin.

Furthermore, as all the accessory and glandular structures, the sebaceous and sudoriparous glands, the hairs and nails are developed from the layer of epidermis, it is evident

that all anomalies of these structures must be included among the developmental anomalies of the first-mentioned epithelial parts.

### ANOMALIES OF DEVELOPMENT OF THE SKIN OF AN EPITHELIAL ORIGIN AND TYPE (EPIDERMIDOSES).

Epidermidoses may be divided into three groups:

The first contains those diseases in which the developmental anomaly is, in the main, an anomaly of the cornification process of the upper layers (keratonoses).

The second includes the changes of pigmentation, which, in the normal skin, are also situated in the upper layers (chromatoses).

The third group embraces those diseases of the upper layers the characteristic of which appears to be an abnormal process of growth of the younger, not yet cornified elements of the upper layers, the so-called prickle layer (akanthoses).

Little as we know concerning the nature of the cornification process, there is no doubt with regard to its anomalies that we have to deal with an essentially chemical change (the formation of a peculiar substance, keratin) which old epithelial formations undergo; that the boundary between the prickle cells of the Malpighian layer and the horny layer is formed by a few strata of cells containing granules (Langerhans' layer), which are formed from the prickle cells proper by the loss of their processes and their more markedly lateral juxtaposition, and that this layer must be regarded probably as decisive with regard to the cornification process, as it is followed immediately by the youngest horny layer.

Closely related to cornification is the physiological process known as secretion of sebum and perspiration. As is well known, the glandular follicles are involutions of the epidermis in the corium, and the epidermal portion of the sebaceous glands appears in the form of the epithelium (one or more layers) which lines the duct of these glands. In sudoriparous glands of larger calibre, the process is evidently the same. Whether the perspiration should be regarded as a product of the transformation of the parenchyma of these glands or as a secretion furnished directly from the blood-vessels has not been decided hitherto. But we will not go astray in associating anomalies of the secretion of the sudoriparous glands, like those of the formation of sebum, with anomalies of keratin formation.

In accordance with these remarks we must consider the abnormal cornification process and the anomalies of secretion as physiologico-chemical processes, which are not necessarily caused by or complicated with an affection of the young layers of epidermis.

On the other hand, the opposite state of affairs sometimes occurs occasionally, *i. e.*, a disturbed cornification process sometimes results in secondary morbid phenomena in the prickle layer, and which may often be explained by the increased pressure of the hypertrophic horny layers upon their basis, for example, in the formation of callus.

In addition to the pure cornification anomalies (keratoses), the keratonoses also include anomalies in the development of the hairs (trichoses), the nails (onychoses), the secretion of sebum (steatoses), and the secretion of sweat (idroses), and, according as an exaggeration, a diminution, or a deviation from the type of development predominates, they may be termed hyperkeratosis, keratolysis, or parakeratosis, etc.

It will now be easy to illustrate the general considerations furnished above by a brief resumé of the anatomo-pathological appearances in the principal diseases belonging to this category.

For this purpose we will call attention, among the hyperkeratoses, to ichthyosis.

Ichthyosis is a pure hyperkeratosis, both in the flat as well as the papillary form.

A massive, fatty, often pigmented horny layer, either flat or in cones like the layers of an onion,

is spread above the prickle-cell layer, which is never thickened, but often diminished in size. The interpapillary rete cones and the papillæ of the flat form of ichthyosis are but little elongated, in cases of ichthyosis cornea often very considerably elongated: they do not branch dendritically, nor do the rete cones ever present a branching growth into the corium. In addition, no inflammatory cellular new-formation or thickening of the tissues is present in the corium and papillæ; on the other hand, the vessels of the papillæ are coiled and twisted here and there; in the sweat glands here and there occlusion and formation of cysts or hyaline cylinders, in the hair follicles pearly formation of cavities from the horny layers, out-growths from the root sheaths towards the hair follicles (these occur also in other chronic affections of the skin and even in normal integument), thickening of the arrectores pilorum.

All the appearances may be attributed to pressure exerted by the immoderate horny growth upon the underlying structure. The structure of the papillary body, for example, points clearly to the merely mechanical development of the changes in it, if they are compared with affections in which active processes are present in the young epidermis layers of the skin.

In like manner the twisting of the papillary vessels and the thickening of their walls must be attributed to the mechanical action of pressure.

With regard to the affections of the glandular and hair follicles in ichthyosis, it is evident that the anomaly of cornification has extended into the main involutions, and thus all the appearances connected therewith may be readily explained.

The hyperkeratoses also include lichen pilaris, a cornification anomaly confined exclusively to the excretory ducts of the hair follicles, and which occurs around the latter as a moderate and usually temporary thickening and accumulation of scales; it has nothing to do with the secretion of the sebaceous follicles, or with the hairs themselves, but with the lamellæ of the horny layers forming their circumference.

When this formation of scales around the follicles is congenital, and is at once renewed after each removal of the accumulation, so that the skin constantly looks like a grater, this congenital form of lichen pilaris must be regarded evidently as a moderate grade of ichthyosis around the follicles, and therefore I apply to it the term ichthyosis follicularis.

In addition to callosities and corns, horns should also be included among the localized hyperkeratoses, which develop free in the tissues but not around the follicles.

Among keratolyses the principal part is played by pityriasis—not that which remains after congestive processes, but the pityriasis alba of the hairy scalp and the pityriasis essentialis rubra of Devergie, the reddened base of which is due to the laying bare of the deeper layer of the Malpighian network, and which is evidently the expression of a cachectic process of the integument in general.

The paratypes of the cornification process, finally, are represented by two diseases which I regard as closely associated, viz.: psoriasis and lichen ruber.

The clinical symptoms of psoriasis prove that this is not an inflammatory process in the skin, as we are generally taught by the text-books.

The redness of the newly-appearing psoriasis nodule can be recognized as a hyperæmic redness, it may be pressed away underneath the finger and is lost with the increase in the scaly deposit, so that no trace of a red inflammatory zone can be observed around the constantly developing plaques, as in other inflammatory affections of the skin. The hyperæmic redness of the base gives place to a venous stasis in the vessels, upon which the hillock of scales rests, and this it is which gives rise to the hemorrhages after the removal of the scales.

The anatomical appearances in psoriasis, so far as they are constant, correspond to the clinical symptoms.

The following are the constant lesions:

Increase in thickness of the horny layer, consisting of opaque dry lamellæ, which are being continually desquamated.

The so-called granular layer, the prickle layer proper, and finally the cylindrical cells at the base of the epidermis present more vigorous and rapid developmental changes; increase of nuclei and nucleoli in the deeper layers of the prickle layer, more marked granular development in the upper cells, which are changing into the true granular cells, in addition to more rapid loss of the prickles, and more close juxtaposition of the cells from the cylindrical layer upwards. Finally, a distinct fibrillation of the prolongations of the cylindrical cells which reach downwards towards the cutis in such a manner that apparently a broom-like appearance of the interpapillary cones of the rete develops at the boundary of the papillæ, and create an impression as if several layers of cylindrical basal cells were situated upon the papillæ.

A real increase in thickness of the prickle layer cannot be observed, nor is there any noticeable thickening and elongation of the papillæ of the cutis.

Finally a constant appearance is the distention of the papillary vessels with blood, here and there more marked sinuosity, and in the vicinity of the vessels—but only after the psoriasis plaque has lasted a long time—an increase of the round and spindle-shaped cells in the papillæ, and œdematous separation of the connective tissue.

All these changes may be observed in psoriasis, but they occur more or less in all keratoses.

The main processes occurring in the epidermis in psoriasis, apart from a moderate increase of the growth of the young epidermis cells, is evidently an anomaly of the cornification process, inasmuch as a more rapid, but at the same time more imperfect cornification of the epidermis cells may be recognized, associated with the increased nutritive changes in the prickle layer. This is expressed clinically by the formation of hillocks of scales out of dry opaque, torn and lamellated, slightly adherent masses of the horny layer. At the same time the observation may be readily made that under these scales, which can be easily removed, the young layer of cells of the epidermis manifests a want of cohesion, so that beneath these cells we reach at once the cylindrical layer of the rete which allows the vessels of the papillæ to shine through, and, being itself readily detached, lays bare the bleeding papillary vessels. The cornification anomaly in psoriasis is associated accordingly with a moderate developmental anomaly of the younger layers of the epidermis, and both combined give rise to the plaques of scales which lend to the disease its peculiar stamp.

Related to psoriasis is a second form of disease, lichen exudativus ruber of Hebra with its variety, lichen planus Wilson, which I also include among the paratypical keratoses. The reasons for this are as follows:

From a clinical standpoint there is an evident similarity with nodular formations of various kinds, which must be certainly regarded as keratoses. But while the initial form of lichen ruber always presents that accumulation of epidermis around the mouths of the hair follicles, known otherwise as lichen pilaris, the nodules in psoriasis soon pass into a diffuse formation of disks. But when the lichen has attained a higher grade of intensity, so that the originally separate red nodules become more closely approximated, then the surface of such groups of nodules becomes covered with a layer of adherent whitish scales, which again gives the appearance of psoriatic skin; the palms of the hands and the soles of the feet especially become covered with a thick scaly fissured cal-

losity of the upper layers of skin, the nails become brittle, thickened, destitute of gloss, the hairs become thin, and gradually fall out.

In fact, the diffuse, inveterate form of psoriasis also approaches this clinical picture of lichen ruber, from the fact that a hyperæmic condition of the papillary layer may develop in both.

The clinical differences between psoriasis and lichen ruber appear to me to consist in this, that the former disease starts from the continuity of the skin, the latter from the epidermis layers of the hair follicles. In psoriasis, therefore, the process spreads towards the periphery in segments of a circle, while the centres of the plaques grow pale and heal. In lichen, however, the disease spreads along the root sheaths of the hair, *i. e.*, perpendicularly to the surface of the skin in an upward or downward direction. Connected therewith may be the fact that in the first case a more marked accumulation of epidermis develops in the form of a pointed nodular mass; in the latter case, upon advancing downwards, a central depression of the nodule of epidermis, a sort of umbilication is produced.

It is evident, then, that the primary affection in lichen ruber as in lichen pilaris and the beginning of psoriasis, is not a true inflammatory efflorescence, but merely consists of accumulations of epidermis the development of which has continued, and which, by pressure upon their base, produce hyperæmia and a secondary fluxion, and thus the red, brownish-red color of the nodules, while the continued predominance of the affection of the horny layer gives rise to the final extensive scaly surfaces.

I may omit further details concerning the nature of those anomalies of secretion of the growth of the hair and nails which are closely related to true keratoses, and also of chromatoses, and must restrict myself, so far as regards the character of the diseases of the prickle layer of the epidermis, with illustrating their nosological character by a few examples.

The type of simple proliferation of the prickle layer (hyperakanthosis) is observed in warts and condylomata; atrophy of this layer (akantholysis) in pemphigus; paratypical growth (parakanthosis) by those forms to which I have applied the term akanthomata (cancer of the skin in its various forms).

In all these anomalies, the chief importance must be attached to the relation of the basal cylindrical layer, the germinal-cell layer of the rete, to the corium, and, in a corresponding manner, the changes produced on the level of the papillary formations of the epidermis and corium acquire the most marked development. In warts and condylomata, as in pemphigus and epithelioma, marked desquamation or accumulation of scales never occurs, the development of the horny substance always takes place in an entirely normal manner.

So much with regard to the relation between the germinal layers of the horny layer on the one hand and the prickle layer on the other. The question further arises, what is the relation between the prickle layer of the epidermis and the upper layer of the corium; whether, as has been so often believed, all changes in the former should not be regarded as merely secondary, as a result of the condition of the papillæ of the corium.

The histological appearances have been interpreted usually as meaning that all the superficial morbid processes of the integument not alone take their departure from the papillary layer, but are also associated with an elongation of the individual papillæ themselves. In fact, the objective appearances teach us that an increase in the volume of the papillæ does really occur (though not produced actively) to a slighter extent in the keratoses, to a greater extent in the akanthoses, and it may be disputed whether the

papillæ do not actually grow. But this statement is made also with regard to all other processes, even when they produce very slight manifestations in the epithelium layer; the "elongated"[1] papillæ constitute the inevitable refrain of the histological melody, and estimates of their increase in length are taken without any regard to the length and structure of the papillæ of the normal skin at the same places.

But it is clear that the papillary layer differs physiologically from the remainder of the corium only in the fact that epidermis cones have grown into it. In the papillary layer, an inflammatory process runs exactly the same course as in the deeper part of the corium.

But the compression of the connective tissue by masses of cells, or an accumulation of exudation is a process which does not give rise to enlargement in the volume of the tissue *in toto*, until the limits of the elasticity of the fibrous tissue have been exceeded and their further compression is no longer possible, and when, on the other hand, a migration of this accumulated mass into the vicinity—into the epidermis on the one hand, and the subcutaneous connective tissue on the other—is not possible. But we are well aware that the vitality of the epidermis depends upon the passage of juices from the vascular corium into the former. We see daily in inflammatory processes that the most varied efflorescences containing serum and pus are formed in the tissue of the epidermis by exudation passing to them from below, and thus there can be no question of an increase in volume of the corium or of its papillary layer alone, so long as the tissues lying upon and around it have not lost the capacity for the absorption of fluid.

But granted that this has happened, what will occur next? The fluid will produce œdema of the subcutaneous connective tissue and corium by which an increase in the volume of the tissue, as well as of the papillary layer of the cutis, may be produced. But in this event the increase in the size of the papillæ must occur uniformly in all directions, not alone in their long diameter.

Let us assume the second case, viz.: distention of the tissue of the cutis with masses which are chiefly cellular. Experience teaches that a passage of the cell masses into the rete occurs in such a manner that the boundary between the cutis and epidermis is concealed and finally presents to the observer the appearance of an apparently homogeneous tissue filled with cells or nuclei. But the papillæ never increase in size on account of the cellular infiltration of their tissue, unless some other factor is active.

From these considerations we must infer furthermore that the growth of the papillæ of the corium may be interpreted only as an abnormality in the growth of the connective-tissue framework of the cutis with the vessels embedded in it, etc. But such an anomaly of development would not be confined to the upper layer of the corium, but would probably appear much more markedly in the layers lying underneath, since the larger vascular trunks are situated in that position.

We may now formulate the following statement: an increase in the volume of the individual papillæ of the corium only occurs simultaneously and proportionally with a corresponding increase of volume in the layers of epidermis corresponding to them. This is a constant appearance in the varieties of the class "epidermidoses," in the "chorioblastoses" with secondary proliferation of the epidermis, and in those conditions of irritation which terminate in hypertrophic condition of the papillary layer, for example, in chronic eczema.

[1] The expression "elongation" in ordinary use is improper, as it refers to growth in all directions.

Which of the two forms of tissue of the skin, the corium or the epidermis, plays the active or primary part in this increase of size is a question which has hitherto not been definitely settled.

I will not dwell longer upon the hyperakanthoses, since the most important points with reference to them have been mentioned above. However, a few remarks must be made to substantiate the description of pemphigus as akantholysis. For this purpose, the difference between the inflammatory and akantholytic formation of vesicles must be pointed out.

Experience teaches that vesicular formations in general occur upon the skin in two ways:

First. As a gradually developing change in the epidermis produced by a superficial or deep inflammation of the cutis, which leads to the formation of meshes and chambers from the epithelial cells in a circumscribed district, and to the filling of these chambers by a serous exudation, *i. e.*, the inflammatory vesicle or vesicular phlyctenula, which may be regarded merely as a large vesicle or confluence of a number of vesicles.

Secondly. As a sudden destruction of the younger layer of epidermis (the prickle cells), which is not due to a typical inflammatory process, but is merely accompanied accidentally or secondarily by congestive phenomena; this is effected by fluid which, escaping *en masse* from the vessels of the corium, lifts up the epidermis as a whole over a circumscribed spot, and effects its separation from the surface of the corium.

The cavity which has been produced in this manner and the fluid accumulated in it are bounded above by the compressed granule layer, over which the stratum lucidum and horny layer are adherent, and below by the papillary layer of the corium, still covered more or less with the remains of the cylindrical layer.

The formation of such vesicles is only conceivable if the Malpighian network has lost the capacity of withstanding the mechanical pressure of the blood serum which escapes from the vessels, and accumulates more markedly in various places in the tissue of the corium. I have therefore applied the term akantholytic to this variety of vesicular formation.

In addition, Unna has described in this form of vesicles (*Vierteljahresschrift für Dermat.*, 1878) a degeneration of the prickle cells (called by him fibrinoid) and their transformation into sausage-like, swollen bands and membranous flat masses, which adhere to the lower surface of the covering of the vesicle (G. Simon), and are traversed by degenerated nuclear formations.

The conclusion may be drawn readily that the form of the vesicle, as it was described in contrast with inflammatory vesicles, only is produced when there is a rapid removal of the epidermis layers from their base over circumscribed localities, during which complete destruction of the elements of the prickle layer and their gradual transformation occurs. This destruction may be produced by blistering remedies, by a burn of the second degree with rapid formation of vesicles, etc.

The destruction of the prickle layer and the vesicular formation may also be effected by a pre-existing diminution in the resistance of the prickle layer, and a series of factors favor the view that in pemphigus we have to deal with the latter form of cachectic condition of the epithelium.

These factors are, in brief, the following:

The clinical signs of inflammatory fluxion are either entirely absent or only auxiliary.

The slight redness observed here and there around the pemphigus vesicles or upon

their base creates merely the impression of a reactive or collateral fluxion. The process always runs its course with desquamation of the roof of the vesicle and formation of young epidermis without spreading deeper into the papillary layer. This is even the case when the skin affection extends over continuous parts of the skin (P. foliaceus Cazenave), and only the prolonged exposure of the surfaces, devoid of epithelium or other injurious influences, may effect here and there deep suppuration, and then the formation of ulcers and cicatrices.

This variety of vesicular formation evidently can be explained alone by the fact that the nutrition of the younger layers of the Malpighian network is impaired, that they offer but a feeble resistance to the fluid escaping through the walls of the vessels and, in unfavorably situated places, these younger layers are pushed away by the fluid and partly destroyed, partly pressed against the horny layer, and finally are thinned and ruptured by the constantly increasing pressure due to the accumulation of fluid. This explanation is supported by the fact that pemphigus is usually met with in cachectic or dyscrasic individuals; that children suffering from congenital syphilis present these vesicular formations most frequently.

Finally, if we examine the relations of pemphigus foliaceus to ordinary pemphigus, it becomes evident that in both cases there is a lesser or greater degree of capacity for resistance on the part of the epidermis, and a mechanical separation of it down to the horny layer. In this manner may be interpreted all statements concerning vesicular formations after long-standing skin diseases of another kind, for example psoriasis, chronic urticaria, chronic eczema, etc.

This does not militate against the fact that such vesicular formations occasionally develop acutely, if the causal factors arise suddenly or spread suddenly to the skin.

Acute vesicular formations, which present either the purely inflammatory type or that of angioneurotic fluxion (the bullous forms of erythema and herpes iris, and the like), do not constitute pemphigus. However, there may be some forms of vesicular formations which distinctly possess the mixed characters of inflammatory and akantholytic vesiculation, *i. e.*, of inflammation of the skin and pemphigus.

Under the term parakanthoses I include those anomalies of the prickle layer which present an atypical (paratypical) growth, in contradistinction to the simple hyperplasiæ.

Two groups of diseases may be included in this category: first, the so-called "molluscum contagiosum," a transformation of the prickle-cells into peculiarly constituted bodies (molluscum bodies), homogeneous and vitreous in the centre, horn-like at the periphery, which according to the most recent investigations have nothing in common with colloid or amyloid degeneration.

We have to deal in the second group with the extension of the atypical condition of the prickle-cells to the connective-tissue layer of the skin, inasmuch as foci of an epithelioidal type develop in the latter, in the form of irregular cell groups, which differ from the interpapillary cone forms, traverse the connective tissue of the corium in all directions, and find new centres of growth in the involutions of the epidermis in the corium. Nevertheless, the standpoint of Thiersch and Waldeyer must be retained, that these atypical epithelial new formations owe their origin to the epidermis, the pre-existing epithelium, or its continuations in the corium.

This form of epithelial new-formation of an atypical character is also distinguished by the formation of nests (alveoli) which may traverse the entire tissue. I have, therefore, applied to this second group of parakanthoses the term alveolar akanthomata.

As an independent and definite morbid appearance, it is peculiar to the various

forms of epithelioma and to carcinoma of the skin. As an auxiliary phenomenon it occurs in various other processes, especially the so-called granulations, which we will discuss later among the chorioblastoses.

The term "papilloma" should be dropped altogether, since neither the warty nor the alveolar forms of akanthomata, individually or combined, can be designated by it. But we need not be too rigorous, and may apply the term papilloma in the future to cauliflower tumors.

In like manner, the term "carcinoma" is superfluous with regard to the skin, both from a histogenetic and histological point of view.

Moreover, the conception carcinoma, in general, is not a definite one, despite the sharp differentiation from sarcoma which Virchow attempted to make.

However, we may employ the term "carcinoma of the skin" when we wish to designate merely a certain group of alveolar akanthomata. These may be divided into two groups, one of which is characterized by marked cornification of the proliferating epithelial cells in the alveolar bodies (the cancer bodies of Waldeyer), in which manner the well-known laminated epithelial nests, horny layer nests, pearly bodies, cholesteatoma globes, etc., are produced. These should be called the true epithelioma of the skin (epithelioma keratodes of Waldeyer), while the other group in which this cornification is very slightly or not at all apparent, retains the name "carcinoma of the skin."

## THE DEVELOPMENTAL ANOMALIES OF THE SKIN OF CONNECTIVE-TISSUE ORIGIN AND TYPE (CHORIOBLASTOSES.)

The developmental anomalies of the corium are characterized by the fact that the growth of the connective tissue in the diseases of this class does not reach the development of really higher types, but remains in an embryonal (cellular) stage, *i. e.*, presents a profuse proliferation of cellular connective-tissue elements, which persist as such (granuloma of Virchow).

These forms of developmental anomaly have a great similarity with a process which develops in the corium after inflammatory irritants, and also depends upon an abundant development of young connective-tissue cells, and is usually termed inflammatory granulation. This process, which terminates every inflammatory process in the connective-tissue layer, and constitutes the first stage in the restoration of wounds and ulcers, also presents some similarity clinically with granulomata. In the granulation of wounds we have to deal also with the formation of nodules from the connective-tissue elements, viz., the granulations of proud flesh, but this is a formation of atypical character with a regular outgrowth of the embryonal elements into bands of connective tissue, vessels, and nerves, and finally the formation of an epithelial covering over the corium which, at the most, has become more tense and devoid of papillæ. On the other hand, the diseases to which we refer now show similar processes, but in an atypical manner, inasmuch as the continuance of the embryonal character of the young new-formation becomes the prominent characteristic.

The diagnosis is evident if the other symptoms of the inflammatory process are sharply outlined, and, on the other hand, resolution of the inflammation occurs. But it has been mentioned heretofore that occasionally the inflammatory irritant is not recognizable distinctly, that furthermore the clinical signs of inflammation appear less sharply defined, that finally its course occasionally is a tedious one, inasmuch as the accumulated embryonal cells persist for a longer period in the tissues, and are only made to disappear by necrobiosis; in such cases the differentiation is indeed more difficult from the true granulations, as developmental anomalies of the connective tissue.

But another question arises: as is well known, the presence of bacilli in some of the

granulation diseases (as in leprosy) has been demonstrated with tolerable certainty; in others, as in syphilis, the infectious nature of the process and the probability of the circulation of a toxic substance in the economy cannot be denied. Under such circumstances, would it not be more logical to regard these features as the essence of the process, instead of the granulation due to the infection? Indeed the question might be raised further whether syphilis and leprosy should not be included rather among the acute infectious processes, such as scarlatina, measles, variola.

This may be answered as follows: Whether the infection is regarded as the essential feature of these processes or not, this much is certain that the injurious influence of the cause of disease must be sought in the fact that the development of the tissue elements occurs in an atypical manner. This it is which is known as syphilitic new-formation, etc. Irritative processes in Virchow's sense also occur, *i. e.*, those which bear the stamp of nutritive disturbances due to inflammatory irritants, but they occur only temporarily or constitute merely an introduction to the formative changes which develop gradually.

An anomaly of development is therefore the essential change which results from syphilitic and leprous infection.

I believe accordingly that we may retain these diseases in the class of developmental anomalies.

I now return to the general nosology of these granulomata, the first group of chorioblastoses, and will consider first those forms of disease included therein.

These are:

Lupus essentialis (idiopathicus) tuberculosus and erythematosus, scrophuloderma, tuberculosis of the skin, leprosy, syphiloderma, rhinoscleroma, granuloma fungoides; if the latter, as French writers now claim, should not prove to be a lymphadenoma.

The following features are common to all these granulomata:

1. They consist of small cellular elements, in an embryonal stage of development.

2. The point of departure and chief site of the granulation new-formation are exclusively the tissue of the corium.

3. The small-celled granulomata appear in more or less sharply defined spots which may be recognized externally by the formation of nodules. These nodules have a dark brownish-red color, firm consistence, often coalesce into flat elevations.

4. They undergo retrogression, inasmuch as they either break up, become cheesy, suppurate, ulcerate, or atrophy without having undergone a loss of substance, and then leave cicatricial depressions.

5. These processes are generally chronic. Many granulomata are distinguished by the high degree of resistance of their cellular elements to necrobiosis. These qualities are not possessed by all granulomata at every period; but they may be possessed or acquired by all, whatever the source of the infiltration has been.

The description of the histological appearances must be reserved for the special part of this work, and I will confine myself here to the following points.

Upon a section of lupoid infiltrated parts, there are found in the tissue of the cutis—embedded between the bands of connective tissue, the vessels and glands—accumulations of cells (granulations), partly in the form of isolated islets, partly scattered over larger surfaces, chiefly around the vessels and lymphatics. Some of these masses frequently present the giant-cell arrangement, *i. e.*, one or more layers of wandering cells which inclose epithelioid-cells in a reticulum which probably starts from the vessels, and in which are situated one or more giant-cells.

Various views obtain concerning the interpretation of the above appearances, *i. e.*, concerning the origin of the cellular elements in general and the giant-cells in particular.

Thoma, and with him Thin, maintain that the lupus elements are white blood-globules which have escaped directly from the vessels, while Lang describes appearances which represent an outgrowth and vitreous degeneration of the walls of the vessels themselves. Jarisch recently has again defended the original cellular proliferation theory and has depicted the gradual transformation from fixed connective-tissue cells into a meshed tissue and then into lupus elements.

It has been proven with regard to the giant-cells that they occur not alone in lupus and tuberculosis, but also in other cellular new-formations, in the later stages of syphilis, in scrofulous proliferations, etc. It is still a disputed question whether these giant-cell formations have been produced by the coalescence of granulation cells, whether they are exuded from the lymphatics or the blood-vessels, whether they are the result of a process of development or retrogression.

The clinical relations of the various granulation tumors to one another may be expressed as follows :

There are granulomata of the skin which possess a clinical and anatomical course similar to that of lupus and the connection of which with syphilis is undoubted. These may be termed syphilitic lupus. This is also true of decidedly scrofulous proliferations in the form of nodular infiltrations. Finally, there is one form of such infiltrations, concerning the etiological factors of which we are entirely in the dark. Hereditary and acquired syphilis may be excluded in such cases ; neither glandular enlargements nor other symptoms point to the condition known as scrofula, and tuberculous infiltrations cannot be found; there can be no question of leprosy. And, nevertheless, the well-known infiltrations appear and develop steadily in the skin of such children who otherwise are apparently healthy. We speak of lupus in such cases, but its characteristics, as opposed to the other forms of granulomata, reside less in the clinical and anatomical signs than in the absence of a definite etiological factor. This lupus is nothing more than a granuloma with very marked persistence of its elements and very chronic course, the causes of which are unknown ; this is the lupus vulgaris, simplex, idiopathicus of Willan.

But although in many cases of lupus true scrofulous deposits in other tissues are absent, nevertheless very good observers recently have laid stress upon the relations of lupus to tuberculosis and scrofula. The common argument that lupus occurs in otherwise healthy individuals is considered of slight import, for example by Volkmann, who points out " that frequently severe chronic diseases of the joints and bones—which present not merely the clinical peculiarities of scrofulous morbid processes, but in which amputation or resection is followed by manifest tubercular deposits in the synovial membranes or even in the medullary tissues of the bones—occur as the sole disturbance in otherwise perfectly healthy individuals, . . . furthermore, that mixed and transitional forms between lupus and manifest tuberculosis of the skin and mucous membranes occur, and that lupus of the tegumentary coverings develops occasionally from tuberculosis of the bones or lymphatic glands."

It is evident that the relationship of lupus of vulgaris to tuberculosis and scrofula is not denied to the same extent as formerly.

The second group of chorioblastoses is distinguished from the first, the granulomata, by the fact that they constitute heterotypes rather than paratypes, *i. e.*, there is an abnormal outgrowth of the connective-tissue elements, but within the bounds of well-known higher forms of development and types of tissue. I apply to them the term desmomata of the skin. They include:

Fibromata, with predominant development of the connective tissue of the cutis and subcutaneous tissue into fibres and bundles of fibres.

Osteomata, with predominant development of osseous tissue.

Chondromata, with predominant development of cartilaginous tissue.

Lipomata, with predominant development of fatty tissue.

Myxomata, with predominant mucoid degeneration.

Hyalomata and colloidata, with predominant hyaline (vitreous, colloid) degeneration.

Xanthomata, with predominant fatty degeneration.

Myomata, with predominant development of muscular tissue.

Neuromata, with predominant development of nervous (?) tissue.

Angiomata, with predominant development of vascular cysts.

Sarcomata, with predominant development of cell forms in an atypical condition.

More detailed consideration of these tumors must be left to special pathology.

Brief mention must be made of those anomalies of development which are characterized by atrophy or congenital defective development of the connective-tissue layer. This includes those changes due to age, and also a probably congenital general atrophy of which previous mention has been made, viz., liodermia essentialis.

The senile changes in the skin are confined to a wasting of the tissue of the cutis, which must be termed shrinking, finely granular opacity, and vitreous (hyaline) swelling, or "morphœa" (E. Wilson). In the epidermis, however, it may result in wart-like growths (irregular cornification), also in atrophy of the hair follicles and increase of pigment. The latter appearance is also peculiar to essential liodermia and is merely the constant pathognomonic expression of irregular atrophy of the skin.

### THE MYCOTIC DISEASES OF THE SKIN.

The diseases caused by vegetable parasites, the dermatomycoses, are distinguished from the others by their peculiar development and course. I will not enter into any details concerning them.

In contradistinction to animal parasites, which also act as disease-producers upon the skin, I would point to the fact that the character of the diseases in question resides in the deposit of the parasite itself, and that the former disappears with the removal of the latter. This is different in the case of the zooparasites, which are partly, as for example, body-lice, not found upon the skin at all, or only accidentally after the removal of the impregnated clothing, while the disease proper—a superficial form of inflammation—may develop later.

In this category are included the diseases of the skin produced by vegetable organisms, which are divided into four groups : mycosis favosa ; mycosis circinata (tonsurans, herpes tonsurans or ring-worm, eczema marginatum) ; mycosis pustulosa (including parasitical sycosis, impetigo parasitaria) and mycosis furfuracea (pityriasis versicolor).

## II. GENERAL SEMEIOLOGY OF THE SKIN. ANTHEMATA AND SYNANTHEMATA THEIR DISTRIBUTION ON THE SKIN.

It is one of the most important objects of dermatology to recognize clearly those elementary changes in the general covering which constitute the basis of the complicated forms, to examine their pathological and anatomo-pathological significance, to define them accurately, and finally to mention the part played by them in the forms of disease themselves.

For this purpose we will discuss the subject analytically, and will present first the

most simple or elementary changes in the skin from a purely morphological standpoint.

We would propose the retention of the term exanthem for the production of a "skin eruption" over the entire body in the dermatology of all languages; and that their elementary forms be termed "anthemata," and finally that the groups which constitute the connecting link between anthemata and exanthemata, be called "synanthemata."

It will not be superfluous to call attention to the fact that these should not be mistaken for the diseases themselves, and must therefore be strictly defined. For example, we may not use the expression "nodules" or "papules" as synonymnous with "lichen;" or employ the term "vesicle" indiscriminately for "herpes." Nor may we speak of lichen or herpes, without further addition, as diseases. When nodules or vesicles of a definite and determined character and origin, are collected in groups, this results in a lichen or herpes. But this lichen or herpes is not yet the expression of a definite morbid process, but merely of a definite character and arrangement of the primary lesions, which may occur in various diseases. Only after the appellation of such a synanthem, for example, lichen or herpes, has been defined nosologically more distinctly, as is done best by the addition of an adjective, may it serve as the name of a disease, for example, lichen ruber or herpes zoster. If we do not wish to go to the length of avoiding all such terms entirely (which would meet with practical difficulties), nothing remains but to define their limits, and to employ them in a corresponding manner.

At all events I may maintain that the distinct recognition of, and adhesion to the following definitions will spare the student the laborious groping in the labyrinth of the previous nomenclature, will render study much easier, and will also appear to the advanced dermatologist as a suitable measure for the removal of the confusion which still predominates.

In the following remarks we will enumerate the morphological primary forms of skin disease, and will place in their appropriate positions the simple anthemata, and, in association with these, the synanthemata which are composed of one or more varieties of the former :

Spots (maculæ) are changes in the color, density and consistence of the surface of the skin without essential change in its elevation. Such "spots" may arise:

1. From congestion, hyperæmia. They are known in dermatology as "erythema" and "roseola." These spots, which always disappear under the pressure of the finger, are merely the expression of an excessive amount of blood within the vessels of the skin. When inflammatory œdema is also present, they are occasionally slightly elevated (erythema papulatum), and then present a faint yellowish color.

The congestive spots may be due to arterial fluxion, and then are bright red; or they arise from venous distention, and their color is then bluish-red, cyanotic. Such erythemata are known as roseolæ, when they are the expression of an exanthematic general affection, for example, in typhus and syphilis. The erythematous rings which develop ordinarily around spots of inflammation are called areolæ, halos.

2. From the passage of the coloring matter of the blood into the skin (hæmatochroses, hæmoglobinorrhœa). These spots occur in the form of yellowish, yellowish-white patches, as the result of incomplete mechanical venous stases.

3. From the passage of the coloring matter of the blood, together with blood-corpuscles. These extravasations are known as vibices when they occur in the shape of streaks, as ecchymoses and petechiæ when they are punctate. They may occur as complications of simple inflammatory and angioneurotic processes (hemorrhagic erythema), in simple and papulous purpura, or as hemorrhagic suffusions in erythema nodosum. If a dyscrasic basis predominates, these extravasations usually are called petechiæ.

4. From the more marked development of the blood-vessels of a region of the skin,

usually under conditions which produce venous stasis, occasionally with coincident thickening of the walls of these vessels. This includes partly congenital changes—vascular nævi, birth marks—partly acquired ones. The latter are called teleangiectases, if they are confined to the vessels themselves; but if this is associated with chronic congestion or inflammatory œdema of the surrounding skin, they constitute the symptomatology of erythema angiectaticum, the acne rosacea of authors.

5. From changes in pigmentation (parachromasiæ). These occur:

*a.* As the remains of previous changes in the skin, especially inflammatory and hemorrhagic processes in the form of patches which are at first bluish-red, then greenish-yellow, then brown.

*b.* As excessive accumulation of the normal coloring matter (hyperchromasiæ), either of the normal yellowish-brown pigment scattered in the lowermost cell-layer of the Malpighian network, or in the tissue of the corium; either congenital as nævus spilus and pigmentosus, or acquired, as chloasma, lentigines, ephelides.

Or of black pigment in melanosis cutis and certain diseases of the internal organs or the entire organism in the cachexia of malarial fever, argyria, Addison's disease, finally in tattooing of the skin.

Or of yellow (bile) pigment in biliary effusions into the skin with jaundice.

Finally, this class includes the accumulation of a yellowish (sulphur yellow) mass in the skin, the character of which has not yet been determined; in xanthoma (xanthelasma, vitiligoidea).

*c.* As the absence or disappearance of pigment (achromasiæ), either congenital as albinismus totalis and partialis, or acquired as vitiligo, leucodermia. Such a loss of color in the skin occasionally is called "morphœa" by writers, especially when the spots are round, and surrounded by a violet rim.

As a rule, the patches previously mentioned are circumscribed, and the following changes are distinguished by more diffuse plaques or regions which are not distinctly circumscribed, or at least, merge readily into one another, and are of larger size, but always flat. The term "patch" is applicable to them only in part. They are usually the terminal forms of pathological processes upon which they impress their stamp so strongly that they may be placed in the same line with the morbid processes themselves.

These include: 6. liodermia, also called glossy skin. The skin appears thin, smooth, tense, less elastic, shining, slightly reddened, and usually somewhat drier. This change occurs most frequently as the result of neuritic processes; also from unknown, but probably congenital causes. The latter disease has been described by different writers under various names. Finger has also described a "liodermia syphilitica."

7. A condition of dryness and loss of gloss in the skin, which is caused by diminished secretion of the sebaceous or sudoriparous glands. This condition I term xerodermia. When due to diminution of the secretion of sweat, it is observed especially in the palms of the hands; in other parts of the skin, when it is due to diminished secretion of sebum, an increased desquamation of dry scales is usually present.

The term pityriasis is applied to the increase of the normal desquamation in the form of constantly produced branny scales, constituting an abnormality of cornification (keratolysis).

Pityriasis occurs only in two forms: as pityriasis simplex or alba, a simple keratolysis, which is independent of the sebaceous glands, and as pityriasis rubra (essentialis), also described by recent writers as "dermatitis exfoliativa," which is an independent morbid process of the entire skin of hitherto unknown origin.

8. Finally, this category includes the board-like and lardaceous œdematous infiltration of the skin, viz., dermatosclerosis or sclerema of the skin, which must be attributed to a general process of stasis. This terminates usually in an atrophic condition similar in appearance to liodermia.

Papules are elevations of the skin above the surface, which contain no free fluid, *i. e.*, accumulation among the prickle-cells of the epidermis. They are produced under various conditions:

*a.* By inflammatory processes in the skin. Such papules constitute larger or smaller circumscribed elevations, which are not connected necessarily with the follicles, but are produced by serous infiltration into the epidermis cells themselves; they are more or less of a bright-red color, solid, and either pointed or depressed at the middle. Central depressions are observed when the excretory duct of a follicle terminates accidentally or pathognomonically (in acne or sycosis) at the top of the papule.

*b.* By excessive cornification of the layers of epidermis lining the sheaths of the roots of the hair and an accumulation of the horny layer at the point of transition of the follicle into the surface of the skin. If marked hyperæmia is present in the cutis at the same time, the papules will have a reddish color; if the hyperæmia is absent, or there is more marked formation of scales, a whitish color. They are not converted into vesicles and pustules like the inflammatory nodules.

*c.* By an elevation of the hair-follicles, especially the downy hairs of the skin, as the result of muscular contraction or contracture. This includes the colorless nodules of goose skin and prurigo.

In this class may be placed most appropriately the synanthem which is commonly termed "lichen."

In the definition of papules given above, we have stated that the second form is distinguished from the others by the fact that they are produced by an accumulation of the epidermis stratum at the mouths of the hair-follicles, and are not converted into vesicles and pustules. The differentiation of this group from the others is necessary, and the term lichen in the dermatological vocabulary is commonly employed for such diseases the nodules of which develop from an accumulation of epidermis. This use, however, has been subjected to the most confusing abuse, and the term lichen is applied at times to diseases, at times to the formation of individual nodules. For example, in order to indicate that certain nodules are isolated in any disease, we speak of lichen disseminatus; to express a suffusion with blood, of lichen lividus, etc. In order to check this confusion, we will retain the term "lichen" as a synanthem, but under the above definition will contrast it with:

*a.* Inflammatory papules of a red color, which are often transformed into other primary forms (vesicles and pustules, wheals). This includes "lichen urticatus" (inflammatory nodules with an œdematous areola), "lichen tropicus," and "agrius" of Willan, which are merely forms of eczema, and "lichen lividus" or "hæmorrhagicus" of the same author.

*b.* Non-inflammatory and non-red nodules of prurigo, which likewise are not converted into vesicles and pustules, and which I attribute to the contracture of the musculi arrectores pilorum.

The term "lichen" may be applied properly to lichen pilaris acquisitus, lichen pilaris congenitus (ichthyosis sebacea), lichen ruber of Hebra, finally lichen scrofulosus.

Tubercles are those nodules which are produced by cellular infiltration of the cutis (granulation). The small or large size may not, as heretofore, be considered decisive with regard to the term papule or tubercle, since the elevations of lupus, which have long been known generally as tubercles, are distinguished by their small size so long as they do not coalesce. The differences in the anatomical and pathological characteristics of both forms constitute a sufficient reason for their differentiation.

The term "granuloma" or "granulation tumor," introduced by Virchow, is really

a purely anatomo-pathological one for an infiltration of the cutis with cells which remain in an embryonal stage. It would be desirable to form a transition stage between the tubercle, the primary lesion of these forms of infiltration, and the developed morbid conditions such as lupus, syphilis, tuberculosis of the skin. The tubercle does not persist as a pure elementary form, but from it are developed a series of complicated transitional formations.

These transitional formations may be called granulations or granulomata, *i. e.*, cellular infiltrations of the cutis without special individualization into diseases. Wheals (pomphiges, urticariæ) are solid elevations above the surface of a flat shape, from the size of a pea to that of a dollar, often confluent; they are produced by œdematous swelling as the result of angioneurotic irritation. Morphologically, they constitute flat elevations of a round, oval, or irregular shape, which are usually pale in the middle, and grow redder towards the periphery. Here and there are observed white (anæmic) areolæ around red wheals. The individual wheals develop and disappear rapidly, and leave no traces of the local process. They are associated generally with violent pruritus, and are observed most frequently in urticaria.

Vesicles are elevations above the surface, containing a free accumulation of serous fluid.

It was explained above that this form of anthemata could be produced by the inflammatory process, as well as by the mechanical separation of the horny layer of the epidermis by fluid coming from below. Vesicles of the latter kind have been called akantholytic vesicles, and thus contrasted with inflammatory vesicles.

Occasionally the vesicles of both kinds have hemorrhagic contents; they may be large or small, tense or loose, of shorter or longer duration; they may remain isolated or coalesce. They are either converted into pustules (the inflammatory ones) or their covering bursts and leaves a spot which is still covered with the youngest layer of rete cells, and readily acquires new skin, or they give rise to an erosion in which the papillæ are laid bare, and over which the entire epidermis must be newly formed.

By the term "herpes" is meant the development of inflammatory vesicles (vesicles, pustules) in groups, with an acute and cyclical course. We retain the term herpes as a form of synanthem, *i. e.*, as an intervening link between individual efflorescences (vesicles) and forms of disease, and the individuality of the latter may be readily retained by the addition of some adjective.

By a strict adherence to the above definition, a differentiation may be made readily between the vesicular formation of herpes and

*a.* The non-inflammatory, akantholytic formation of vesicles in chronic pemphigus.

*b.* The non-cyclical formation of vesicles, which do not occur in groups, in various simple, inflammatory processes of the skin; for example, in eczema, the stigmatoses, etc.

*c.* The chronic formation of vesicles as the result of of dyscrasic processes, for example, syphilis.

The term herpes, as a synanthem form, is then retained for the following processes:

*a.* For the acute inflammatory formation of vesicles, occurring in groups and running a cyclical course, in herpes zoster.

*b.* For the acute inflammatory formation of vesicles, occurring in groups and running a cyclical course, in the diseases known as herpes præputialis, progenitalis, facialis, phlyctænoides.

*c.* For the acute inflammatory formation of vesicles and pustules, occurring in groups and running a cyclical course, in erythanthema neuriticum, toxicum, and essentialis; finally, the herpes impetiginosus, first described by me, which etiologically is still undetermined.

Pustules are elevations above the surface with purulent contents accumulated free

in the epidermis. They always develop from vesicles, and, therefore, indirectly from papules of an inflammatory character. Their anatomical structure has been discussed above.

The term ecthyma is applied to an eruption of large pustules, each of which is situated on a hard, elevated, red base, and terminates in the formation of dark, hard, greenish or dark-colored crusts, and then in the development of new skin.

This pustular formation, upon the basis of stasis, occurs in all cases in which the conditions produce, on the one hand, incomplete stasis, on the other hand, inflammation; most frequently, therefore, when an obstruction to the return flow of blood, produced by constitutional or mechanical causes (heart disease, varicosities from mechanical causes), is present, and in addition, inflammatory irritants act upon such parts of the skin.

Under the term erythanthema I refer to all those symptom-groups upon the skin which are characterized by the combination of various primary forms, such as nodules, vesicles, pustules, wheals, which occur with a variable arrangement upon a reddened (inflammatory) base.

Observation teaches that the same morphological combinations may occur as the result of causes directly known to us, as a result of angioneurotic irritants (toxic medicinal exanthemata) and also of neuritic processes.

The erythanthemata are referred to in the nosology, according to the cause of disease, as erythanthema essentiale (Hebra's erythema multiforme), erythanthema toxicum, and erythanthema neuriticum.

With the primary and elementary changes in the skin here mentioned, are associated a few more elementary forms, which, in part, are simple, direct effects of mechanical injuries, in part are the sequelæ of these primary lesions, their terminal stages of development, or their remains, and are called secondary efflorescences.

To this class belong:

The erosions (less properly excoriations), fissures and rents (rhagades), and ulcers. These three forms of loss of substance may arise from the most varied mechanical, chemical, or pathological processes. They are distinguished from one another merely by the depth and form of the losses of substance. Of chief importance is the circumstance whether the epidermis alone, and then whether the horny layer or the prickle layer has been affected by the lesion. Either superficial redness without a solution of continuity is produced, or a destruction of the upper skin in the shape of a circle or line with exudation of blood-coloring matter, or even of serous fluid or blood in substance, if the irritant has acted as far as the papillary layer. Rhagades, fissures with steep edges, may arise in this manner if the horny layer is especially thick or very tightly drawn (palm of the hand and skin of the external ear) or deep erosions may be produced. If the injury has destroyed in part the papillary layer itself, even deeper losses of substance occur with subsequent formation of cicatrices. Ulcers of the skin which naturally heal by cicatricial development alone, constitute a variety of such losses of substance which occur in morbidly changed tissues and constitute the terminal stage of their retrogressive metamorphosis.

Scales (squamæ) are the lamellæ of the horny layer which are loosened from the epidermis. This occurs physiologically in the form of small branny plates because new cells of the younger layer are constantly undergoing cornification and casting the old ones off. If this shedding process increases, we speak of scaling or branny scaling when smaller plates, and of desquamation when larger white plates of the horny layer are cast off. The first variety occurs in the disease known as "pityriasis," the latter as the

terminal stage in the superficial inflammations of the skin. Occasionally the cast off scales, which are still adherent to the surface of the skin in larger pieces, form hillocks like those found commonly in psoriasis.

Crusts and scabs are those secondary products of disease which are produced by the drying of pathological fluids excreted upon the surface of the skin. If they consist of pure serum, they have a darker, more brownish color; if there is an admixture of pus, a lighter bright-yellow to honey color, and from admixture with blood they are colored dark to blackish. They first constitute soft, then harder, inelastic friable masses. They may be more or less firmly adherent to the base.

Scars (cicatrices) are new-formations formed of band-shaped connective tissue, which appear in the site of losses of substance, when these have extended into the tissue of the corium. They contain vessels and nerves, but no glands and hairs, and the papillary shape of the surface is absent. Their coloration, from the most delicate white and rosy red (especially while they are young) to dark pigmentation, depends chiefly upon the distribution and depth of the new-formed vessels in them.

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The forms of anthemata and synanthemata, just described, have long attracted the attention of pathologists by a form of arrangement, spread, and distribution indicative of a certain amount of conformance to law.

As a rule, the elementary lesions represent various figures: circles, segments of a circle, ellipses, biscuit shapes, concentric circles with or without a punctate centre. In addition, lineal figures may be constructed readily in each exanthem as the connecting lines between the individual anthemata, which have a fixed direction for each region of the body, on the back parallel to the ribs, lower down more horizontal, on the shoulders as circular girdles, on the neck or the upper part of the chest converging towards the manubrium of the sternum, in the groins parallel to Poupart's ligament, on the thighs parallel to the sartorius, etc. (O. Simon).

Another important feature is the very frequent symmetrical arrangement of the anthemata.

This symmetry finds its most frequent expression in the simultaneous occurrence of efflorescences upon both arms and both lower limbs, as well as on definite parts of the same; for example, both palms of the hands and soles of the feet, both elbows on their flexor and extensor surfaces, similarly on both knee-joints, both axillæ, both sides of the chest, neck and scalp. Symmetry is manifested likewise between the flexor and extensor aspects of the upper and lower limbs, the ankle and wrist joints, the legs and forearms, elbows and knees, arms and thighs, axillæ and groins.

However, there are other diseases in which the non-symmetrical arrangement is the rule; for example, in herpes zoster and nævi.

Certain other forms of regularity in arrangement also occur, such as the formation of geometrical figures in many efflorescences, furthermore the apparently linear arrangement along the ribs of efflorescences on the chest and trunk, the circular arrangement around the umbilicus; finally a certain kind of juxtaposition and development alongside of one another in certain circular anthemata, so that two scaly circles which touch one another at the periphery, for example, in psoriasis, instead of presenting doubly marked contours at these points, entirely lose their previous shapes and terminate in the formation of biscuit shapes, etc.

In attempting to explain these facts, a series of anatomical investigations and experiments upon the skin have been partly made directly for this purpose, partly utilized

in this direction. An unbiassed view of all the observations at our command teaches that the actual demonstration of a connection in the distribution of the anthemata with the branches of the nerves of the skin is afforded in but few diseases, viz., in herpes zoster and in leprosy, as well as in those other diseases which we have classed together as neuritic dermatoses. The proof has long been furnished that linear tracts assume a different direction in different parts of the body and that this direction depends upon the conditions of tension of the skin and subcutaneous connective tissue, the latter in turn upon the direction of the fibres of the connective tissue in and below the integument of the part in question (Langer).

This regularity is at the same time an expression of the general laws of development of the body, which occurs on the one hand in the direction of greatest tension, and on the other hand is dependent upon the points of fixation of the fibres upon the bones and fasciæ.

In addition to the direction of the fibres of the connective tissue and the varying tension of the skin produced thereby, the position and direction of the main trunks of the nerves and blood-vessels, and even the arrangement of the glands depend upon the same laws.

We may say, therefore, that the law of arrangement and distribution of the anthemata upon the skin, in accordance with the general laws of development of the human body, depends upon the direction of the connective-tissue fibres and the tension of the skin, but not upon the trunks of the nerves and vessels, the position and direction of which themselves depend upon the fibrillation and tension of the growing layer of connective tissue.

## III. GENERAL ETIOLOGY OF DISEASES OF THE SKIN, THEIR RELATIONS TO THE GENERAL ORGANISM.

The general integument is distinguished from the other organs of the body by the fact that it is not subservient to the nutrition of the organism mainly in one definite direction, but that it subserves many, yes all, functions of the vegetal and animal sphere to an almost equal extent. Under certain circumstances, therefore, a disease of the skin may also mean a disturbance in the respiratory process of the body, in the secretion and osmosis of the fluids of the tissues, in the peripheral and central innervation and the sensations of pressure and touch due to them, in the distribution of blood over the entire body, in the production and maintenance of the heat necessary to life, etc. And for this reason the list of causes of disease presents a very varying picture. No wonder that pathology thought to find here an opportunity for the settlement of all possible disputed questions in its domain.

Charles Lorry, the real founder of dermatopathology, first made a division of diseases of the skin into those which are the result of a general morbid process (symptomatic), and those in which the integument suffers independently (idiopathic), and herein he has been followed by all dermatopathologists up to the present time, whatever their principle of classification may have been.

We will now consider these etiological relations more in detail.

1. It has always been held that the so-called acute exanthemata, likewise the various affections of the skin in typhoid fever, cholera, glanders, syphilis, scrofulosis, and tuberculosis; certain furuncular processes, the deposit of morbid substances, hemorrhages into the skin and subcutaneous tissue, eczema and the like, in diabetes, gout, rheumatism;

seborrhœa, acne, alopecia, eczema, urticaria in anæmia and chlorosis, furthermore in scorbutic and leukæmic disease of the blood and the like, must be regarded as diseases of nutrition.

2. In addition, a series of observations tend to show that diseases of individual organs of the body may act as the direct cause of skin diseases. As illustrations I may mention: affections of the central and peripheral nervous system, which correspond to the neuritic dermatoses, and affections of the vaso-motor centres which correspond to the angioneuroses of the skin.

Diseases of the circulatory organs, which are followed mainly by stasis dermatoses.

Diseases of the organs of the vegetal system, the gastro-intestinal tract, liver, spleen, kidneys, suprarenal capsules, to which the most varied forms of skin diseases may be due, such as erythanthemata, urticaria, pruritus, etc.

Diseases of the genital system, the sequelæ of which upon the integument (erythanthemata, diseases of the glands, changes in color), for example, chloasma uterinum, play a great part, particularly in the female sex.

3. Those physiological agencies which, under certain circumstances, may act as a cause of disease upon the organism in general, or upon parts of it, naturally act also as etiological factors in diseases of the skin.

This includes heredity, in part of individual diseases as such, for example, ichthyosis, birth-marks, psoriasis, prurigo, syphilis, scrofula, perhaps also gout and rheumatism, in part the disposition to certain diseases as to loss of hair or its excessive growth, to certain glandular and pigmentary anomalies of the skin, to catarrh of the skin, etc.

Furthermore, age, sex, occupation, food, dwelling, etc., in single individuals, climate, temperature, meteorological and telluric conditions in general (endemic and pandemic diseases of the skin). It must be left to special pathology to utilize these individual factors in the special forms of disease, since we have to deal merely with the general relations of the causes to the effects on the integument.

We shall therefore mention briefly with regard to age: that superficial catarrhs and excoriations, also accumulations of sebum are frequent in nurslings, that urticaria may occur during the first year of life as a premonition of subsequent prurigo, that scrofula also makes its appearance, as a rule, during the first years of life.

Psoriasis usually appears after the first decennium, acne rosacea during the second decennium; advanced life suffers from atrophy of the skin, constant pruritus, and new-formations of various kinds.

As far as regards sex, those diseases are more frequent in females which are connected directly or in a reflex manner with the genital system: chloasma, pruritus, acne, etc.

With regard to occupation, special mention should be made of a few substances and manipulations which give rise to diseases of the skin; either erythemas and eczemas when the substances are mild irritants, deeper spreading dermatitides when they are more concentrated. The occupation of sugar refiners (grocer's itch), of shoemakers (formation of callus upon the skin of the thigh from hammering), of washer-women and kid-glove makers, of workers in lime and metals, of bakers, etc., is as important an etiological factor as in those diseases of the skin which occur in tar, anilin, or paper factories.

Some progress has been made in the last few years in our knowledge of the effects upon the skin of general conditions such as climate, the soil, temperature, the atmospheric conditions.

White has formulated the following conclusions with regard to America:

1. Prurigo, pellagra, lichen exsudativus ruber do not occur in America (?).

2. Skin diseases due to uncleanliness, especially to animal parasites, are more infrequent in America than in Europe.

3. Some severe diseases which are associated with constitutional affections are more infrequent or run a milder course in the United States than in Europe or those countries in which they are endemic (lupus, syphiloderma (?), leprosy).

4. Certain diseases of the skin, especially of the glands, and those connected directly with the nervous system, are more frequent in America than in Europe (seborrhœa, acne, perhaps also eruptions from heat, herpes. urticaria, and pruritus).

The physiological factors mentioned above act as producers of disease, not alone upon the entire organ, but also directly upon the skin, and thus constitute a transition to the causes of idiopathic diseases of the skin which will now be considered.

4. No one doubts the development of the latter from direct external injuries, whether of a physico-chemical or mechanical nature. But attention may be drawn to this fact, that we have to deal not alone with qualitatively injurious irritants, but often with a merely abnormal increase or diminution in the amount of action, so that substances which are innocuous in themselves, for example, water, may act as irritants.

To this class also belong the parasitic organisms which may act as irritants upon the skin. Their enumeration and detailed consideration must be reserved for the special part.

There are a few questions in the etiology of diseases of the skin which have not been answered hitherto in a generally harmonious manner. These may be formulated in the following manner:

1. Apart from the recognized connection between individual diseases of the skin and gout and rheumatism, is there an independent group of skin diseases which, with the same certainty that, for example, syphilitic eruptions are attributed to syphilis, may be called arthritic (Bazin), *i. e.*, directly due to an arthritic type of constitution or produced in the latter alone by accidental external irritants? And furthermore:

2. Is there an independent group of chronic skin diseases which must be attributed to an herpetic (Bazin) or dartrous (Hardy) character of the entire organism?

Both questions must be answered in the negative. None of the supporters of these hypothetical diseases is able to give an objective picture of the symptoms, in the same manner as is readily done by the text-books with regard to scrofula, syphilis, anæmia, chlorosis, etc., although these in reality are merely abstractions.

In fact, the chief advocates of these diatheses, Hardy and Bazin, are strenuously opposed to one another. While Bazin's "arthritisme" is simply denied by Hardy, both believe in the existence of "herpetisme" or "dartre," but in entirely different senses. Arthritismus may be accepted in a certain sense, since gout and rheumatism have long been recognized as nosological entities; furthermore, because the presence of uric acid deposits in the skin in gout, and the occurrence of hemorrhages in them together with rheumatic pains (purpura rheumatica), may be made responsible to a certain extent for a peculiar connection between the dermatosis and the constitutional disease, although, with the exception of those mentioned, there is scarcely any other symptom of an "arthritic crasis" upon the skin.

This doctrine of diatheses has always been associated with consequences which have made the treatment of skin diseases somewhat difficult—it may even be said mystical. We refer to the conception that the skin should be regarded as a place of deposit for the morbid substances produced in the body by the diatheses, and furthermore to the fear that the chronic skin diseases, being cured upon the surface, will be driven back into

"more vital" organs. We would simply discard this entire series of ideas, were it not that it still holds sway in the minds of many.

After excluding everything that cannot withstand exact investigation, if we take a general survey of the relations between diseases of the skin and diseases of the organism or of other organs, we will be struck with the following facts:

There are numerous changes in the skin which appear in one and the same form as the result of various etiological factors. The elementary lesions may be produced by different irritants of the most varied kinds. Pustules may be produced by the bite of an insect, by inflammation of the trunk of a nerve and by iodine poisoning, although they may present the same structure, and on the whole, the same course and termination. Various morbific influences, which are termed constitutional when they arise in the organism itself, and chronic irritants when they come from the outside, may exercise such an influence upon the skin that its nutrition, power of resistance to external influences, its ability to perform the various functions devolving upon it may be more or less impaired. But this fact is not manifested—as the advocates of the diathesis theory imagine—by diseases of a definite character, but by a series of constantly recurring symptoms, though of frequently changing combinations, which present in general the character of enfeebled nutrition, atrophy, and occasionally even paratrophy of irregular development or anomalous nutrition.

As by certain physiological conditions, for example, old age, the skin may be made to assume a changed condition (senile atrophy), which we recognize as dryness with vitreous swelling, accumulation of pigment, falling out and atrophy of the hair, pruritus senilis, etc., so also the skin may be affected in a similar manner by all those constitutional diseases which produce cachexia, by malarial diseases, scrofula and tuberculosis, diabetes and leukæmia, carcinoma and syphilis. The changes produced thereby will vary somewhat according to the conditions from which they develop, but they never lose the character of lowered nutrition, imperfect restoration of tissue, functional weakness, cachexia.

As in the mucous membranes, certain chronic changes of nutrition very often present the picture of a superficial chronic inflammatory process which we know in the integument as chronic eczema. Not that the skin is constantly eczematous in such cases, but that, as the mucous membranes of such individuals react by catarrh to the slightest irritant, and as these catarrhs are characterized by special obstinacy, so in these individuals the skin falls into a condition of great sensitiveness to irritants and obstinate retention of the eczematous disease. The forms of these eczemata gradually become mixed and certain paratypical eczemata develop.

With these are associated chronic anomalies of cornification (pityriasis tabescentium and scrophulosorum), cachectic conditions of the glands and their excretory ducts (lichen cachecticorum and scrophulosorum, xeroderma) and acantholytic affections of the upper layers of skin (pemphigus), finally disturbances of innervation (pruritus, prurigo cachecticorum).

It is evident that this series of skin diseases really does not differ much from those called "arthritides" and "dartres" by Bazin and Hardy, but to which they attribute an independent and peculiar position in pathology, which we cannot concede to them.

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The subject of disturbances of innervation of the external integument appears very recently to have undergone thorough investigation, and the influence of the nervous

system upon the nutritive disturbances of the skin seems to be, at the present time, the most favored dermatopathological theme.

The part played by the blood-vessels is also directly concerned, since the muscular action in the walls of the vessels is regulated by the vaso-motor nerves. These must, therefore, be considered first with regard to nutritive disturbances. There are important reasons for believing that it is not exclusively the centrifugal influence transmitted by the motor nerves, and therefore also the vaso-motors, but another centrifugal influence which influences directly the nutrition of the tissues. It is very probable that this centrifugal influence is transmitted along the centripetal sensory nerve fibres.

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The question now rises, What are the pathological data with regard to all these general assumptions ?

In the first place, with regard to the influence of the vaso-motors: the action of the muscular coat of the vessels, which must be regarded in the normal condition as maintaining a medium condition of tension (tonus), will give place, as soon as the physiological condition is disturbed, to paralysis of the constrictors and spasm of the dilators, when dilatation of the lumen occurs, and to the opposite conditions when narrowing occurs. The question next arises, What must be the point of departure of such irritants to produce the above result ? At the present time, the ganglia of the sympathetic and medulla oblongata, perhaps also the entire spinal cord, are regarded as vaso-motor centres, and in addition, certain parts of the brain are said to be connected with the vaso-motor centres in the medulla (Eulenberg and Landois). Irritation of these centres may be produced directly by noxious agents of a chemical or vegetable nature circulating in the economy, or occurs from the periphery in a reflex manner.

Those changes in the lumen of the capillaries which are manifested physiologically by changes in the amount of blood (blushing and pallor of the skin), in the blood pressure, the rapidity of circulation and the temperature, also constitute the type of all the pathological changes of vascular tonus.

Abnormal irritation of the vaso-motors does not give rise to the so-called neuro-paralytic inflammations, such as inflammation of the eye after injury to the trigeminus, inflammation of the lungs after section of both vagi, etc.

Perroud[1] has collected a number of cases of neuro-paralytic hyperæmia in human beings, which had persisted for a long time without being followed by nutritive disturbances. In addition, these conditions occur not infrequently without elevation, indeed even with diminution of temperature, for example, in partial myelitis, infantile paralysis, and progressive muscular atrophy. Finally, stress must be laid upon the results of C. Ludwig's experiments on the salivary glands : irritation of the peripheral end of the submaxillary nerve, which is derived from the chorda tympani, produces hypersecretion of saliva even if the veins are tied ; the manometric pressure in Wharton's duct is, at the same time, greater than the pressure of the blood in the arteries, so that the hypothesis of an active dilatation of the afferent artery also appears to be excluded. It would seem, therefore, that the secretion of the glands is not under the influence of the vaso-motors and perhaps an inference is also justifiable with regard to the sebaceous and sudoriparous glands of the skin.

Disturbances of vaso-motor innervation will not explain the chief forms of nutritive disturbance of the skin, though this does not imply that these processes have no connection with vaso-motor innervation. There can be no doubt that the arterial redness and the elevation of temperature at the beginning of inflammation of the skin, and the venous disten-

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[1] Charcot, Leçons, p. 137.

tion in stasis, must be attributed to changes in the lumina of the vessels and these again to the influence of the vaso-motors. But their influence is exhausted with this effect.

There are forms of inflammation, however, in which a disturbance of the vascular tonus continues for a long time and may be distinctly recognized in addition to the inflammation; this vaso-motor disturbance then imparts to the process a peculiar appearance, that of an angioneurosis.

It follows that every attempt to convert pure angioneuroses of the skin into independent forms of disease must be useless, because the simple hyperæmias meant thereby must be regarded either as merely increased physiological functions (for example, blushing, pallor) or as the beginnings and part-symptoms of inflammation of the skin (inflammatory hyperæmia), or finally as part-symptoms of neuralgic or neuritic processes.

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We now pass to the consideration of the part played in diseases of the skin by the trophic fibres which run their course in or with the cerebro-spinal nerves, but which, I repeat, have not hitherto been isolated anatomically. It is a long known fact that an irritant applied at any part of the distribution of a sensory nerve may result in trophic disorders in the tract supplied by it. Such an irritant applied to the surface of the skin, *i. e.*, upon the extreme periphery, and which directly affects the peripheral distribution of sensory nerves in the skin, may be followed by a dermatitis, and on the other hand an irritant applied to a sensory nerve-trunk may spread, not alone centripetally, but also centrifugally and produce trophic disturbances in the skin.

The production of trophic disorders of the skin through the agency of nerve elements is therefore an undoubted fact, however we may be inclined to interpret them. Anatomo-pathological proofs have also been adduced in various diseases.

We have furnished illustrations above in the hemiatrophia facialis of Romberg, in herpes zoster, and in the traumatic forms of "glossy skin" of American surgeons. As additional examples we will add the appearances described in leprosy by Danielsen and Boeck (sclerosis of the spinal cord, spinal meningitis, atrophy of the medulla), also by Tschirjew (cell proliferation in the cervical segment of the central canal and atrophy of the cells of the posterior horns of the spinal cord), etc. In pemphigus Babesiu has recently demonstrated sclerosis of the posterior roots and Goll's columns and atrophy of the anterior horn.

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With the pathological appearances here mentioned are associated some pathological experiments. Experiments made by Charcot and Brown-Séquard had given negative results or, at the most, had shown that diseases of the skin after destruction of the spinal cord were due merely to anæsthesia and paralysis and the consequent inability of the animals to avoid noxious influences. According to Charcot, the case is different when inflammation follows such an injury of the spinal cord; then trophic disturbances terminating in gangrene make their appearance upon the skin.

Babesiu and Irsai have recently made direct experiments upon animals, and after unilateral injury of the spinal cord have produced a vesicular eruption and atrophy of the skin upon the same side, but only after the lapse of a few days, *i. e.*, only after the development of a myelitis; after a few days these symptoms disappeared.

Recent experiments aim to throw light in another manner on the relation of skin diseases to the nervous system. They attempt to prove that in certain dermatoses, in which clinical symptoms of a nervous affection do not occur, anatomical changes in the nerves are present nevertheless and must be regarded as the cause of the former.

In this connection, I will refer to the important article by Jarisch on the coincidence of diseases of the skin and of the gray axis of the spinal cord.

The following is the history of the case reported by him:

A woman, æt. sixty-one years, who had suffered five years previously from a vesicular eruption with pruritus, was admitted to hospital with an eruption of nodules and vesicles covering the face, trunk and upper limbs, while in other places merely a vesicular formation upon the soles of the feet and a few vesicles upon the abdomen were visible. Then bed-sores upon the sacrum and pneumonia developed, from which the patient died. The autopsy showed interstitial nephritis, and also changes in the spinal cord from the third cervical to the eight dorsal vertebræ, in which coarse granulation and degeneration of the ganglion cells and sclerosis of the gray substance were demonstrated.

This clinical history enables us to recognize distinctly:

*a*. That we have to deal with an affection of the gray substance of the spinal cord from the third cervical to the eighth dorsal vertebræ, in those places in which, according to Charcot, the trophic centres of the skin are situated;

*b*. That the skin affection appeared over a surface corresponding exactly to this localization;

*c*. That it was associated with acute decubitus upon the sacrum and soles of the feet, a disease which neuropathologists have sharply defined as the expression of an affection of the spinal cord. Not a mere coincidence, as Jarisch with great reserve has expressed himself, but a causal connection between the spinal affection and the skin disease is here rendered certain.

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In addition, Jarisch has examined seven cases of hereditary and acquired syphilis, one of psoriasis, and one of lupus erythematosus.

In two children with hereditary syphilis who died of general atrophy after the lapse of a few weeks, he found atrophy of the ganglion cells of the spinal cord and swelling of the basement substance, as well as circumscribed spots in the commissure and anterior horns, which the writer did not venture positively to call inflammatory; in two other cases, there were appearances the interpretation of which Jarisch himself declares doubtful (crumbling masses around the vessels, hyperæmia of the gray substance?); then a case of acquired syphilis with various secondary symptoms, but without cerebral or spinal syphilis. The autopsy showed hyperæmia of the gray matter, hemorrhages into the lower dorsal cord, and œdema of the tissue of the gray substance. The second case of acquired syphilis, in which cerebral syphilis was evidently present, presented a similar appearance and in addition atrophy of the ganglion cells; the third case, with a probable diagnosis of syphilis, but in which cerebral symptoms were present, showed merely sclerosis of the gray substance of the cord, which could be interpreted more properly as a senile process or atrophy than as inflammation.

The examination of the cases of psoriasis and lupus erythematosus, both of which presented spinal symptoms during life, also showed in part sclerosis, in part inflammation (?) of the gray axis in the first case and vitreous foci in the central and lateral portions of the anterior horns, which were visible even macroscopically.

Only in some of these cases do the appearances justify a conclusion of the presence of a morbid process due to syphilis, which may be termed an inflammatory tissue change. We believe that among these should be included only the first and second cases of hereditary syphilis, in addition to the positive case of "herpes iris." The first and third cases of acquired syphilis suffered from, and died with, marked symptoms of Bright's disease, and the second presented clinical symptoms of pronounced cerebral syphilis, such as are abundantly reported in literature.

With regard to the psoriasis and lupus erythematosus, the results of the examination in the latter permit an interpretation which is perhaps favorable to their nervous origin; concerning the psoriasis it is difficult to form an opinion.

It must be remembered also that the two cases of hereditary syphilis died in a short time from general cachexia.

The opinion is, perhaps, not unjustifiable that the atrophy of the ganglion cells of the spinal cord in these cases was merely an expressions of the cachectic condition in general.

Attention must also be called to the fact that an examination of the intervertebral ganglia and peripheral nerves was not made in these cases and that changes in the skin might be produced in this manner as well as affections of the spinal cord as the result of neuritis ascendens.

Moreover, various observers maintain that, in inflammation and slow destruction of large portions of the spinal cord, they have observed no changes in those parts of the skin innervated by them.

We now pass to the second point, viz.: to those observations which endeavor to furnish a demonstration of peripheral nerve changes.

Attention must first be directed to the investigations of Leloir and Déjérine.

These authors found :

*a.* In vitiligo, parenchymatous neuritis, disappearance of the axis cylinder, partial distention, in individual fibres, of the sheath of Schwann by drops of myelin ; in other fibres, complete disappearance of the myelin and axis cylinder, also atrophy of the nerves.

*b.* In two cases of ichthyosis, Leloir observed the same appearances. But these were evidently cases of atrophy in cachectic individuals, and were only accidentally complicated with congenital ichthyosis.

*c.* In two cases of ecthyma, Leloir found degeneration of the peripheral nerve distribution, in the first one also in the posterior roots. But in both cases a disease of the spinal cord was demonstrated clinically (general paralysis, right hemiplegia).

*d.* In chronic pemphigus of a cachectic individual, degeneration of the nerves (?) in the region of the vesicular formation, which we must explain simply as cachexia of the skin and perhaps also of the affected ends of the nerves.

*e.* In cases of acute gangrene of the skin and leprosy, Leloir found the spinal cord normal, but parenchymatous and interstitial neuritis of peripheral twigs.

To these we will add a case of Schwimmer which was examined by Babesiu.

The patient suffered from interstitial nephritis, sclerosis of the brain, the skin was atrophic in all its parts, the tissue of the corium converted into a mesh of elastic fibres ; the nerves were surrounded by granules and drops of fat, their sheaths were thickened.

We have to deal evidently, as in some of Leloir's cases, with atrophy of the skin, and at the same time of its peripheral nerves. As in this case, the appearances found by Leloir are evidence rather of the secondary than of the primary nature of the skin affection. We may summarize the subject in the following manner :

1. Primary diseases of the brain or spinal cord are often followed by trophic disturbances of the skin, which present usually an inflammatory character terminating in atrophy or destruction, or are modifications of previously existing processes.

2. After experimental lesions of the spinal cord, such appearances, in favorable cases, are presented upon the skin, but only when inflammation of the injured nerve parts has occurred.

3. As is clearly proven, primary diseases of the spinal ganglia are also followed by trophic affections of the skin (zoster, etc.) or by changes in the course of those already existing.

4. This holds true also of the neuritis of the peripheral nerves in which a spread of

the inflammatory process is observed toward the periphery as far as the skin, together with trophic disturbances upon the latter.

Our experience concerning injuries of nerve-trunks seems to indicate that only such traumata which produces irritation or inflammation of the peripheral nerve-trunks will result in the well-known nutritive disturbances with the atrophic terminal symptoms of glossy skin, etc.

5. The anatomical examination of the central nervous system in various skin diseases, in which clinical symptoms of a central nervous affection were not manifested, hitherto has furnished in part negative results, in part positive ones of such a character that for the present the assumption of a primary central nervous disease does not seem to be well established in such cases.

6. The anatomical examination of the peripheral nerve distributions has not succeeded in furnishing proof that we have to deal with primary affections of the nerves which is followed secondarily by the skin affection as a sequela, *i. e.*, with a trophoneurosis.

If we rely alone upon what has been actually proven, what remains of the etiological structure which has been based upon the nerves? Really very little—merely the fact that functional disturbances and diseases of the nervous system may produce secondary functional disturbances and diseases of the skin. But the facts and the reasoning of pathologists are different An abundance of clinical material, poorly arranged and improperly interpreted, is adduced as proof to substantiate the neurotic nature of skin diseases. From congenital nævus to eczema there is no dermatosis which is not attributed to faulty innervation and by ingenious arguments is termed a "trophoneurosis," or "trophopathy." This term has begun to exercise the pathologists in a lively manner during the last few years, and the majority of skin diseases are now called trophoneuroses. But this term is only justifiable when applied to secondary trophic disturbances of the skin as the result of nervous diseases, and in this manner it was also employed formerly.

But a decided veto must be passed on the attempt to apply the term trophoneuroses to all skin diseases (erythema, eczema, prurigo, lichen, herpes, miliaria, pemphigus, purpura, nævi, acne rosacea, elephantiasis arabum, sclerema, leprosy, ichthyosis, atrophy of the skin, myxœdema, neuroma, pigmentary and developmental anomalies). Should it not be considered probable that morbific factors may act upon various apparatus of the body at the same time, that the nervous symptoms in leprosy, for example, can and must be explained by the simultaneous action of the parasites circulating in the blood, not alone upon the skin, but also upon other organs and among these chiefly the nerves.

If we are satisfied to accept the facts with regard to the neuropathological foundation of skin diseases simply as they are and as they probably will remain, we may briefly formulate the relation of skin diseases to the nervous system as follows:

Those skin diseases which, by their clinical symptoms, prove their origin from anatomically demonstrable nervous affections (central or peripheral neuritis), and they alone, must be differentiated from simple inflammation of the skin and the angioneuroses; on account of the difference of interpretation now existing, they should not be called "trophoneuroses," but rather "neuritic dermatoses."

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Finally, the last question to be solved with reference to the etiology of skin diseases is that of their parasitic origin. Animal as well as vegetable organisms have long been

recognized as an etiological factor of various skin diseases, and their mode of action has been described in detail.

Moreover, recent investigation has demonstrated the existence of micro-organisms in a number of skin diseases in which this had been suspected before, and in part it has shown that the development of these diseases is dependent directly upon their existence and further development in the economy.

Micrococci and bacteria have been demonstrated in measles, scarlatina, roetheln, variola and vaccinia, erysipelas, dissecting wound pustules, splenic fever, typhoid fever, cholera, the bites of snakes, scorpions, and spiders, etc.

Furthermore, in the chronic infectious diseases, like syphilis, tuberculosis, lupus, leprosy.

In my opinion, two main propositions must be adhered to rigidly:

1. We are not justified in regarding a skin disease as produced by micro-organisms from the mere demonstration of their occurrence in pieces of the skin. In addition, the following conditions are necessary:

*a*. The accurate characterization and, if possible, a clear differentiation of the parasites.

*b*. The constancy of their occurrence in the skin.

*c*. The proof that they have not come from the outside.

But in order that such an affection, after the fulfilment of the above conditions, may be termed an infectious disease, we consider it necessary to demonstrate the occurrence of exactly the same parasites in other organs of the body, in addition to the skin, and also in the blood.

If these conditions are fulfilled, the assumption of an infectious disease is justifiable, even though there are no positive results from attempts at conveying them to other organs.

Under these conditions, the general pathology of the skin cannot definitely regard the majority of the above-mentioned diseases as infectious until further data are furnished by investigation in this respect. The question of the systematic classification of these diseases, even if the etiological question is settled positively in favor of infection, will depend upon the fact whether the nature of the disease in question is more sharply characterized than by other nosological factors. This much is certain, that in the group "infectious diseases" must be classed very different nosological forms; in the first place, the acute exanthemata, then malarial diseases, then granulomata. Common to all of these is an important factor, viz., a circulating poisonous microzoon which reproduces itself in the organism. Nevertheless, pathology will and must oppose the union of diseases like scarlatina, intermittent fever, syphilis, and leprosy into one nosological group, because the anatomo-clinical pictures of these diseases, despite their pathogenetic relationship, present insufficient analogies to one another, and because the solidarity of these affections appears to be demonstrable clinically not in all, or even the majority of those relations upon which are based the pathological character and independence of a disease, but only in a single though important (etiological) relation.

## IV. GENERAL REMARKS ON DIAGNOSIS, COURSE, AND PROGNOSIS.

The diagnosis of skin diseases in one of the most difficult subjects to the beginner, because he always runs the risk of neglecting the nosological process as a whole, in view of the complexity of details presented by the diseased integument. A considerable share of the

fault is due to the manner in which the symptomatology of skin diseases and their primary lesions has been converted into chaos by a diffuse system of nomenclature.

In order to further the determination of a correct diagnosis, a series of diagnostic doctrines and dogmas should not be given to the pupils, but the teachers themselves would aid the cause most by coming to an agreement concerning the assertion of simple, strict, and logical conceptions in the nomenclature. This being assumed, the pupils may be told in addition :

1. The clinical history should always be taken before the inspection ; the statements of the patient should be received only with the greatest caution, but should by no means be neglected.

2. In the examination of the objective appearances, if possible, the entire integument should be looked at uncovered, even if the patient states "there is nothing anywhere else."

3. The skin may be in a condition of active and passive congestion, although this may not constitute a direct morbid factor. The mere act of undressing and the diminution of temperature produced thereby often produces active congestion ; moreover, the integument of some individuals is so sensitive that almost every irritant, even mere contact with a foreign body and the like, produces sudden irregular contractions and dilatations of the vessels of the skin (districts of spasm and paralysis) which are manifested by alternating red and pale patches, often even by acute œdema (elevation of the surface of the patches, even the formation of wheals).

4. By means of sight and touch, it must be determined whether changes of color are due to congestion (the red patches of which, when recent, may be removed by pressure), or to serous infiltration (here also the redness and elevation of the surface may be removed, at least in part), or to cellular infiltration (in which this cannot be done) ; whether it is due to the serum or coloring matter of the blood, or to blood in mass, or finally to increase or diminution of the pigment.

5. Not the individual anthemata, but their relation to one another as synanthemata and exanthemata, their distribution, and, in the main, their course, in detail and as a whole, finally their relation to the organism constitute the sum of the objective data upon which the diagnosis must be based. It must be pointed out in particular that the examination of the expansions of the mucous membrane, which are near the integument, and also of other epithelium-bearing membranes, should never be omitted.

6. The subjective symptoms are important in so far as the statements with regard to them harmonize with the objective appearances and the course of the disease. In this connection, the feeling of pruritus, in particular, plays an important and pathologically interesting part in skin diseases. Even the absence of pruritus in certain, for example, syphilitic forms of anthemata, while entirely similar non-syphilitic ones are characterized by violent pruritus, may often be of an importance which cannot be underestimated.

The manner in which skin diseases develop from anthemata into synanthemata and exanthemata is as manifold as the pictures of the developed diseases themselves, and finally a series of varying forms are presented in their transitions from the acute into the chronic stage or their definitive retrogression in the residua which they leave behind, such as pigmentation and cicatricial formation.

Finally, the prognosis of skin diseases, which is on the whole more favorable than that of other parts of the organism, is connected very closely with the diagnosis, course, and treatment. With the increasing perfection of methods of treatment, especially with

reference to individual groups of disease, the history of dermatology has made considerable advances for the better.

## V. CLASSIFICATION OF SKIN DISEASES. HISTORICAL.

We now pass to the consideration of the classification of skin diseases.

In the system which I have published recently,[1] an attempt has been made, at least in the upper classes, to form natural groups, *i. e.*, those characterized by a series of essential qualities. There are nine[2] of these groups (classes), which I will now mention, and will refer you to my "System" for a detailed justification of their subdivisions down to individual diseases. I will here reiterate that the clinical unity of the groups of disease and the diseases themselves—in so far as they are presented as wholes to the observation of the pathologist—has been regarded as alone decisive in determining the principles of classification, and that individual general pathological factors (such as the cause, localization, the anatomical and functional factors, the symptomatology in detail, the course and terminations) have only been placed in the front rank when they actually coincide with the real nature of the class, group, or disease in question.

The following is the system :

### First Class.

Simple inflammatory dermatoses (dermatitides simplices).

A. Dermatoses with the character of superficial inflammation of the skin (dermatitides simplices catarrhales, catarrhs of the skin).

I. Family. Diffuse superficial inflammations of the skin. (Surface catarrhs of the skin.)

1. Mere hyperæmia predominant :
   Erythema : *a.* simplex.
   *b.* papulatum.
2. Sero-purulent exudation predominant :
   Eczema : *a.* typicum.
   *b.* paratypicum.
   Varieties : rubrum.
   papulatum.
   vesiculosum.
   rhagadiforme.
   pustulosum.
   squamosum.

II. Family. Erosive superficial inflammations of the skin (stigmatoses).

1. Produced by animal parasites :
   Parasitic stigmatoses.
   *a.* Entomoses :
   due to head lice.
   " body lice.
   " clothes lice.

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[1] "System der Hautkrankheiten." Wien : Braumueller, 1881.

[2] I need not prove that this is not an attempt to classify skin diseases "upon a neuro-pathological basis," as Kaposi has discovered in his "Lectures" which have recently appeared.

due to bed-bugs.
" fleas.
" flies (culex, musquito).
" caterpillars (Bombyx processionea).

*b.* Acarinoses:

due to the harvest-mite (Leptus autumnalis).
" the tick (Ixodes ricinus).
" the hair-worm (Acarus folliculorum).
" the acarus (Acarus scabiei=Sarcoptes hom.).
" the barley-mite (Acarus hordei=Krithoptes [Geber]).

2. By injuries of other kinds (the vital restorer of Baunscheidt, cupping, and the like):
Traumatic stigmatoses.

III. Family. Follicular superficial inflammations of the skin (perifolliculoses).

1. Only around the mouths of the follicles:
Miliaria alba et rubra (should perhaps be included among the epidermidoses [akantholyses] ?)
2. Also around the excretory ducts of the follicles and the follicles themselves.
Without coincident implication of the sheath of the hair:
Acne.
With coincident implication of the hair-sheaths and hair:
Sycosis.

IV. Family. Superficial stasis inflammations of the skin.

1. With the termination in new-formation of skin.
Ecthyma.
2. With the termination in cicatrices:
Cutaneous ulcers.

B. Dermatoses with the character of deep-spreading inflammations (dermatitides simplices phlegmonosæ, simple phlegmons of the skin).

I. Family. Phlegmons of the skin in layers.

1. Due to burns:
Combustio.
2. Due to freezing:
Congelatio.
3. Without external injury:
Pseudo-erysipelas (phlegmone diffusa idiopathica).

II. Family. Localized plegmons of the skin.

Furunculus.
Parasitic varieties:
Due to the sand-flea (Pulex penetrans).
" the gadfly (Œstrus).
" the guinea-worm (Filaria medinensis).
Anthrax (carbunculus).
Aleppo and Biskra boils.

III. Family. Stasis phlegmons of the skin.

Phlebitis and lymphangioitis cutis.
Erysipelas.

## Second Class.

### Angioneurotic Dermatoses.

Dermatoses with the character of a widespread disturbance of the vascular tonus, in addition to more or less well-marked inflammatory nutritive disturbance.

I. Family. Infectious angioneuroses of the skin (acute exanthemata, eruptive fevers).

1. With predominant catarrhal character:
   - Erythematous exanthemata:
     - Roseola of typhoid fever.
     - of cholera, etc.
     - Scarlatina.
   - Papular exanthemata:
     - Rubeola.
     - Morbilli.
   - Vesiculo-pustular exanthemata:
     - Varicella infantum.
     - Vaccinia.
     - Miliaria crystallina (only accompanying fevers, or also an independent epidemic disease [?])
2. With predominant phlegmonous (diphtheritic) character of the inflammation of the skin.
   - Variola.
   - Maliasmus (carbuncle of glanders).
   - Pustula maligna (carbuncle of splenic fever).

II. Family. Toxic angioneuroses of the skin (medicinal exanthemata, etc.).

1. With predominant inflammatory congestion:
   - Erythanthema toxicum.
     - Varieties:
       - Maculo-papular forms: Erythema toxicum, pellagra, acrodynia.
       - Vesicular and bullous forms: Herpes, pemphigus, and eczema toxicum.
       - Pustular forms: furunculi and ecthyma toxicum.
       - Hemorrhagic form: Purpura toxica.
2. With predominant spasm of the vessels of the skin:
   - Urticaria toxica.
3. With occlusion of the vessels and termination in necrosis:
   - Ergotism.

III. Family. Essential (idiopathic, diathetic) angioneuroses of the skin.

1. With predominant inflammatory congestion:
   - Erythanthema essentialis (idiopathicum).
     - Varieties:
       - Maculo-papular forms:
         - *a.* Superficial: erythema multiforme, papulatum, circinatum, iris, annulatum.
         - *b.* Deep-seated: erythema nodosum.
       - Vesicular, bullous, and pustular forms:
         - Herpes circinatus, iris, annulatus.

Herpes phlyctænoides.
Herpes impetiginosus (impetigo herpetiformis).
Eczematous and pemphigoid efflorescences upon an angioneurotic basis, in hysterical individuals and the like.
Hemorrhagic form : purpura (peliosis) rheumatica.

2. With predominant spasm of the vessels of the skin.
Cnidosis (urticaria essentialis, chronica).
3. With dilatation and new formation of vessels :
Erythema angiectaticum (acne rosacea).

## Third Class.

### Neuritic Dermatoses.

Dermatoses produced by an affection of sensory (at the same time trophic ?) nerve elements.

I. Family. Neuritic dermatoses with a cyclical course.
Herpes neuriticus (zona, herpes zoster).
Herpes febrilis (hydroa febrilis) (?).

II. Family. Neuritic dermatoses with a cyclical course.

1. With predominant inflammatory congestion (neuritic inflammatory processes of the skin) :
Erythanthema neuriticum.
Varieties :
Maculo-papular forms : erythema neuriticum.
Vesicular and bullous forms : herpes, pemphigus, and eczema neuriticum.
Pustular forms : furunculi and ecthyma neuriticum.
Hemorrhagic form : purpura neuritica.
2. With predominant spasm of the vessels of the skin (neuritic œdema of the skin) :
Urticaria neuritica.
3. With predominant atrophy of the skin (neuritic atrophy) :
Liodermia neuritica (glossy skin).
Onychogryphosis neuritica.
Alopecia neuritica.
Leucodermia neuritica.
4. With true necrosis of the skin (neuritic necrosis) :
Neuritic phlegmon (chronic).
Decubitus neuriticus (acute).

## Fourth Class.

### Stasis-Dermatoses.

Dermatoses with the character of a passive disturbance of circulation and impaired veno-so-lymphatic absorption.

A. With incomplete stasis.

I. Family. Stasis-hyperæmias and anæmias.
Cyanosis.
Local ischæmia of the skin.
Hemorrhage of the skin from mechanical stasis.

Hæmoglobinorrhœa from mechanical stasis.

II. Family. Stasis-transudations.

1. The transudation remains in a fluid form :
   Œdema.
2. The transudation leads to induration and hypertrophy of the connective tissue :
   Elephantiasis Arabum.
3. The transudation leads to atrophy of the connective tissue :
   Sclerema : *a.* neonatorum.
   *b.* adultorum (sclerodermia).

B. With complete stasis.

The only Family : stasis-necroses.

Traumatic decubitus.
Idiopathic gangrene.
Local asphyxia with symmetrical gangrene.
Malum perforans of the foot.
Ainhum.

## Fifth Class.

### Hemorrhagic Dermatoses.

Dermatoses in consequence of increased passage of red blood-globules through the walls of the vessels without inflammatory congestion or local stasis.

I. Family. Traumatic hemorrhages.

Ecchymoses (petechiæ, vibices).

II. Family. Essential (independent of external injuries) hemorrhages.

1. With slight general disturbances of the organism.
   Purpura : *a.* simplex.
   *b.* papulosa.
2. With predominance of general disturbances :
   Morbus maculosus (purpura hæmorrhagica).
   Scorbutus.

## Sixth Class.

### Idioneuroses of the skin.

Functional anomalies of the distribution of the cutaneous nerves without trophic changes in the skin.

A. Seusory neuroses of the skin.

I. Family. Neuroses of the tactile sense (æsthesionoses).

Hyperæsthesia.
Anæsthesia.
Paræsthesia.

II. Family. Neuroses of cutaneous general sensation (dermatalgias).

1. The neurosis occcurs as pain :
   Neuralgia.
2. The neurosis occurs in the form of itching :
   As a pure sensory neurosis :
   Pruritus.

Combined with a motor neurosis (spasmodic contraction of the arrectores pilorum).
Prurigo.

B. Pure motor neuroses of the skin.
A single family. Dermatospasm.
Cutis anserina.

## Seventh Class.

### Epidermidoses.

Anomalies of development of the skin of an epithelial origin and type.

A. Anomalies of the formation of horny matter and of the secretion (keratonoses).

First Series. Keratoses in the narrower sense.

I. Family. Hyperkeratoses.

1. Diffuse :
Ichthyosis diffusa : *a.* simplex.
*b.* histrix.
2. Around the follicles :
Lichen pilaris.
Ichthyosis follicularis.
3. In spots, but independent of the follicles.
The tegumentary horn, cornu cutaneum.
Callosities, tyloma.
Corn, clavus.

II. Family. Parakeratoses.

1. Diffuse :
Psoriasis.
2. Follicular :
Lichen ruber and planus.

III. Family. Keratolyses.

Pityriasis : *a.* (alba) simplex.
*b.* (rubra) essentialis.
Dermatitis exfoliativa infantum.

Second Series. Trichoses.

I. Family. Hypertrichoses.
Hypertrichosis congenita.

II. Family. Paratrichoses.
Trichorrhexis nodosa.
Trichoptilosis.

III. Family. Atrichoses.

1. Diffuse :
Diffuse alopecia : *a.* simplex.
*b.* pityrodes (Pincus).
2. In spots :
Alopecia areata.

Third Series. Onychoses.

I. Family. Hyperonychoses.
Hyperonychia.

II. Family. Paraonychoses.
Onychogryphosis idiopathica.

III. Family. Onycholyses.

Onycholysis idiopathica.

Fourth Series. Steatoses.

I. Family. Hypersteatoses.

Seborrhœa : *a.* oleosa.

: *b.* crustosa.

II. Family. Parasteatoses.

Grutum.

Milium.

Atheroma (in addition to acrochordon and nævus follicularis).

Colloid milium (colloid degeneration of the parenchyma of the sebaceous glands) and Haloid milium (vitreous degeneration of the parenchyma of the sebacous glands).

III. Family. Asteatoses.

Xerodermia (dry skin) : *a.* congenital.

*b.* acquired.

Fifth Series. Idroses.

I. Family. Hyperidroses.

Idiopathic hyperidroses.

II. Family. Paridroses.

Chromidrosis.

Bromidrosis.

Hæmatidrosis.

Uridrosis.

III. Family. Anidroses.

Idiopathic anidrosis.

Dysidrosis (cheiropompholix).

B. Anomalies of pigment formation in the skin (chromatoses).

I. Family. Hyperchromatoses.

1. Congenital :

Nævus pigmentosus :

Varieties : spilus.

verrucosus.

pilosus.

2. Acquired :

Chloasma : fuscum (uterinum).

nigrum (melasma).

Lentigines (ephelides).

II. Family. Parachromatoses.

Discoloration of the skin from icterus, argyria.

From tattooing.

From Addison's disease.

From the cachexia of intermittent fever, etc.

III. Family. Achromatoses.

1. Congenital :

Albinism : *a.* universalis.

*b.* partialis.

Poliosis.

2. Acquired :
Vitiligo.
Premature canities.

C. Anomalies of the prickle layer of the epidermis (akanthoses).
I. Family. Hyperakanthoses (simple akanthomata).

1. Proliferation of the prickle layer upon the surface (warty akanthomata) :
Verruca.
Condyloma acuminatum.

2. Proliferation of the glandular coils (cutaneous adenoma) :
Idrotadenoma (sweat-gland adenoma).
II. Family. Parakanthoses.

1. With transformation of the prickle cells into so-called molluscum corpuscles (which are not known accurately) :
Molluscum (contagiosum of authors).

2. With formation of nests in the cutis (alveolar akanthoma) :
*a.* With distinct cornification of the new-formed epithelium cells.
Epithelioma :
Varieties : superficial (rodent ulcer).
deep.
*b.* Without cornification of the new-formed cells :
Cutaneous carcinoma :
Varieties : soft.
colloid.
melanodes.
III. Family. Akantholyses.
Pemphigus essentialis :
*a.* Acute.
*b.* Chronic.
Varieties : bullosus.
foliaceus.
Cachectic gangrene of infants.

## Eighth Class.

## Chorioblastoses.

Developmental anomalies of the skin of connective-tissue origin and type.

A. Excessive development of the connective-tisue layer.
Single Family. Hyperdesmoses.
Macrosomia.

B. Paratypical growth of the connective-tissue layer (Paradesmoses).
I. Family. Granulomata of the skin.
Lupus esssentialis (idiopathic) :
*a.* Tuberculosus. Varieties : L. scleroticus.
L. exuberans.
*b.* Erythematosus.
Scrophuloderma :
Papulosum and vesiculosum (lichen scrophulosus).
Squamosum (pityriasis scrophulosa).
Tuberculosum (lupus scrophulosis).

Gummosum.
Ulcerosum.
Tuberculosis of the skin.
Leprosy :
Tubercular.
Macular.
Anæsthetic.
Syphiloderma :
Maculosum.
Papulosum and squamosum.
Vesiculosum.
Bullosum.
Pustulosum.
Tuberculosum (lupus syphiliticus).
Gummosum.
Ulcerosum.
Rhinoscleroma.
Granuloma fungoides (Lymphadenoma cutis [?]).
II. Family. Desmomata (connective-tissue tumors).
Fibroma cutis.
*a.* Disseminatum.
*b.* Keloides.
Osteoma (new formation of bone).
Choudroma (new formation of cartilage).
Lipoma (fatty tumor).
Myxoma (mucoid tumor).
Hyaloma (vitreous swelling of the skin).
Colloid tumor.
Xanthoma (fat-like change of the skin).
Myoma (new formation of muscle).
Neuroma (new formation of nerves).
Angioma (new formation of vessels).
*a.* Phlebangioma } Varieties : simplex.
*b.* Lymphangioma } cavernosum.
Sarcoma.

C. Disappearance or congenital defective development of the connective-tissue layer.
Single Family. Adesmoses.

1. General and diffuse :
Liodermia essentialis (congenital [?]).
2. Partial :
Striæ atrophicæ cutis.

## Ninth Class.

### Dermatomycoses.

Fungoid diseases of the skin and its appendages.

I. Family. Mycosis scutulata (favosa, lupinosa, Favus).
Dermatomycocis favosa.
Trichomycosis "

Onychomycosis favosa.

II. Family. Mycosis circinata (herpes tonsurans, ring-worm).

Dermatomycosis circinata :

Varieties :

D. Maculo-vesiculosa.

D. marginata (eczema marginatum)

D. diffusa (imbricata Manson).

Trichomycosis circinata.

Onychomycosis circinata.

III. Family. Mycosis pustulosa.

Dermatomycosis pustulosa (impetigo contagiosa [?])

Trichomycosis pustulosa :

Varieties :

Tr. barbæ (sycosis parasitaria).

Tr. capillitii (kerion Celsi).

IV. Family. Mycosis furfuracea (pityrodes).

Dermatomycosis furfuracea (pityriasis versicolor).

## VI. GENERAL TREATMENT OF SKIN DISEASES.

The treatment of skin diseases depends to a great extent upon the prevailing pathological views and changes with them.

As matters stand to-day, there is a general tendency to treat purely local affections of the skin by local remedies, with the greatest possible avoidance of internal remedies. In skin diseases, on the other hand, which are due to a nutritive disorder of other organs of the body, the treatment of the diseased internal organs must be carried out according to general therapeutic principles.

It goes without saying that we are far from believing in the vicarious nature of the localization of the disease, in the possibility of "driving back" the skin affection into the organism. Nor, on the other hand, may the dermatologist deny certain truths which the physiology of the skin allows us to recognize. We refer, for example, to the undoubted connection between local circulatory tracts and the general circulation, and, therefore, between the amount of blood in the skin or in individual parts, and the circulation in general (condition of the heart and the peripheral resistances to circulation) and in other peripheral circulatory tracts. Also to the action of cutaneous irritants upon nutrition. Recent investigations have shown that feeble cutaneous irritants produce contraction of the peripheral vessels, thus increase the force of the heart's action and the rapidity of the current of the blood. Result: increased temperature. On the other hand, vigorous cutaneous irritants produce dilatation of the peripheral vessels, and may thus diminish the temperature. According to Roehring, a coincident irritation of the vagi slows the pulse and circulation, and diminishes the respiration, so that this constitutes a compensation to too-marked coolness.

Accordingly the action of external cutaneous irritants is settled beyond a doubt, but they should not be employed in skin diseases, except in the two cases in which we desire to increase the intensity of any local process, for example, a torpid inflammation, or when the cutaneous irritant is employed as a caustic for the production of necrosis of the tissues.

A further application of the physiology of the skin to therapeutics consists in the fact that we can divorce ourselves from the previous conception that the office of the integument as a respiratory organ is so extensive and important, that an affection of the former over an extended surface per se endangers nutrition.

It also follows that no harm follows the application of substances which coat the skin over a great extent, and this is as true of water as it is of salves and plasters.

I will here make an observation, however, with regard to the employment of the continuous bath recommended by Hebra. As is well known, this was first employed only in severe burns, then also in chronic diffuse diseases of the skin, and in extensive suppurative processes, for weeks and even months. As a rule, it was found that no injurious effects upon nutrition occurred even in very feeble individuals; in some cases the restoration of large losses of substance and in some the relief of the pains of burns occurred in the bath. But I have become convinced from prolonged personal observation that, in the large majority of cases, neither a favorable influence upon the cur of chronic skin diseases, nor upon the diminution of pain or pruritus, or upon the course of extensive suppurative processes and burns is effected thereby. Many patients cannot tolerate them in the least; the foudroyant toxic symptoms (convulsions, etc.) which constitute the last scene in severe burns, occurred in the bath as constantly and certainly as when applications of oil and cotton batting and the like were employed. I think, therefore, that a very restricted curative effect can be attributed to Hebra's continuous bath, and that this is not proportionate to the requisite preparations, the exciting effect upon the patient, etc.

In skin diseases, external local procedures must be mainly considered. General therapeutics, on the other hand, furnishes the standard of general internal treatment, when this is indicated.

With regard to the local treatment of skin diseases, it must be pointed out that, as a rule, only the symptoms and not the diseases are cured by them. We possess remedies which will improve or cause to disappear anthemata of various kinds, erosions, swelling or dryness of the skin, changes of pigment, anomalies of cornification, etc., but we possess no external remedies against eczema as such, against ichthyosis, prurigo, etc., regarded as diseases.

Attention must also be called to the fact that the number of external remedies is small, but the capacity of manipulating them is very great, and that the chief secret of success depends more upon technical skill than upon the number of remedies.

I will now glance hastily at the most important internal and external remedies, in order to call attention to a few points of general importance.

When employed in moderation, water is a remedy which is very useful for the functions of the skin (cleansing, softening, removal of the secondary morbid products). When applied too frequently or at too high or low a temperature, it acts as an irritant even upon the healthy skin, and produces eczema.

Upon inflamed parts it acts favorably by conveying higher or lower temperatures (warm and cold compresses), or by producing evaporation in the form of Priessnitz' compresses. Water compresses should therefore be wrung out well before being applied, and, as a rule, they should not be placed directly upon the skin, but upon some intervening substance impervious to water.

The application of hydro-therapeutics has proven less suitable, in general, to produce recovery of local chronic processes and, on the other hand, even mild procedures are apt to give rise to irritative conditions of the skin. However, advantage will often be derived in psoriasis, prurigo, etc., from systematic packs, half-baths, and rubbings, in nervous dermatoses from douches (especially with warm water), in epidermidoses in general, from macerating steam baths and steam douches.

Baths containing medicinal substances have always been employed in skin diseases. With regard to those prepared artificially, it may be stated that the addition of an alkali to the bath, for example, potash, soda, borax (perhaps with the addition of starch, Bulkley), softens the epidermis and diminishes congestion of the skin.

Sulphur is employed either as sulphide of calcium or potassium, for example, 30–50 Grm. of Vlemingkx' solution being added to the bath, or the body of the patient being smeared with a solution of the sulphur before entering the baths.

The action of artificial sulphur baths upon the skin in those cases in which we desire to kill parasites (scabies), etc., is similar to that of its medicinal application. Like the natural sulphur waters, they produce good results occasionally in chronic itching skin diseases.

Hebra has employed tar baths, the patients being first smeared with the tar and then placed in the bath.

Baths of corrosive sublimate are employed occasionally in syphilis as a substitute for or adjuvant to the ordinary anti-syphilitic measures (5.0 to 30.0 for a full bath of 32–35° C.[1]), or locally in chronic dermatoses of various kinds, for example, as a hand-bath (1:2,000 to 1:500).

With regard to natural mineral baths, special attention must be called to the fact that their action upon the skin is mainly macerating and solvent, they remove secondary deposits, and occasionally are slightly irritating, *i. e.*, they chiefly affect the epidermis.

The passage of substances from the bath through the human integument is not so easy as is commonly believed. If we grant that gases pass through in small quantity and that some solid substances, especially in a fatty emulsion, may be pressed through after long inunction, we must also remember that the living skin does not permit the passage of substances from watery solutions of salts which simply come in contact in the bath with the intact skin, and that even the absorption of water by the layers of the skin is usually moderate.

We now pass to the consideration of the substances employed with water, and in the first place soap. Soap is a combination of fatty acids and alkalies, which are dissolved upon being rubbed in some water on the skin, and again undergo a new combination of the constituents which have become free and the alkalies of the surface of the skin.

In combination with water, especially when poor in salts or distilled, it serves as the best agent for cleansing the surface of the skin. A carefully-prepared, simple soda soap, made of good materials, always proves sufficient, either cold or warm; it should contain no excess of free alkali, which will macerate the skin.

For curative purposes, stronger potash soaps, which present at the same time a softer consistence, are employed with more success. The so-called soft soap, which is now manufactured with tolerable purity, is a sort of ointment which, when not used as a caustic, should not produce an alkaline or burning taste on the tongue. Stronger potash soaps act like solutions of caustic potash, *i. e.*, not merely macerating, but even caustic, if they are employed for a prolonged period ; this was often done formerly in chronic skin diseases, for example, in prurigo, etc., by Hebra or others, in cycles of soap inunctions and soap poultices. I no longer employ this plan of treatment.

In like manner, I rarely employ combinations of soap with other remedies, because

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[1] It is best to prepare the following solution: Hydr. bichlor. corros., 20.0; Natrii chlor., 50.0; Aq. dest., 200.0 for four baths. The water must be distilled, the bath-tub covered, and not made of metal.

it is very difficult to make an accurate quantitative determination of the remedy employed in this form, and it is not always easy to secure a uniform distribution in the soap. I never use glycerin soaps because the amount of glycerin contained in them (up to fifty per cent), is withdrawn from the saponaceous substance, and, instead of a soap, a smeary mass which acts the reverse of cleansing is uselessly applied to the skin.

It is self-evident that the addition to soap of substanees for which the skin is impervious is entirely useless.

I recommend tar, creasote, and carbolic soaps less strongly than distilled tar in substance, which is rubbed well into the skin in a thin layer, by means of a strong brush.

In parasitic diseases, especially scabies, I have seen very good results with an avoidance of all inconveniences, from a storax soap.

Additions of dusting powders or sand, pumice stone, marble dust, sand soap, in order to rub the skin more vigorously, are employed occasionally with good results.

Finally a combination which Hebra recommended highly, that of soap and alcohol in the form of spir. saponatus, I employ only in those rarer cases in which we have to deal with direct irritation of the skin, especially in morbidly changed peripheral innervation, in torpid inflammatory processes, because alcohol, a drying, water abstracting remedy, like water, glycerin, etc., does not act favorably on the nutrition.

Fats also play a great part in the therapeutics of skin diseases. Their first object is to cover the diseased parts uniformly, and thus protect them against external irritants, especially against the air and its contents. For this purpose they are especially suited by their flexibility, smoothness, and the readiness with which they may be applied.

This property of the fats is heightened still further by their undoubted power to maintain and stimulate the nutrition of the skin. According to physiological experiments, finely subdivided drops of fat pass so much more readily through the epidermis to the vessels, the more vigorous and prolonged their contact with the surface of the skin.

Associated with these, on account of their similar consistence, are glycerin, which, combined with powdered starch, is employed as an admirable, ointment-like substance (glycerolate, glycerolé d'Amidon of the French Pharmacopœia), and vaselin and paraffin, gelatin-like substances of great flexibility, which do not become rancid like fats, like them are very suitable for application as protective substances, but as I believe are inferior in their direct conserving and nutritive action on the tegumentary tissue.

Fats produce the greatest effect upon the skin when they are employed in the greatest possible density. Accordingly, an ointment upon an eczematous surface would have a more permanent curative effect than a fluid fat or oil, and a plaster would be still more effective than an ointment. With regard to the first case, this is really in accordance with facts, granted that the ointment—like the oil—is kept constantly on the skin, *i. e.*, not merely rubbed in with the finger, but applied carefully with linen cloths, and properly renewed. With regard to the plaster, however, its consistence can be secured only in two ways, either by the admixture of fatty acids, or wax with resin (gum resins, balsams), or caoutchouc dissolved in turpentine, or by a combination of the fatty acids with lead. The first are resin plasters, the others lead plasters.

On account of the extreme irritating action of the resin contained in them upon the skin, the application of the resin plasters is restricted to a minimum when we have to deal with inflammatory processes, or those which readily pass into inflammation.

Therefore the lead plasters alone remain, and may be applied to the skin for a long time without irritating it, since the oxide of lead, which is destitute of carbonic acid, saponifies easily with the fatty acids. If some fat is added to such a plaster (empl. plumbi simplex, empl. diachylon simplex), the preparation acquires the consistence of a cerate, and in this manner presents the most perfect form possible, in which fat can exercise its favorable effects upon the surface of the skin. This is the reason of the unexcelled action of the so-called Hebra's ointment (ung. diachylon simplex, made of empl. diachylon simplex, carefully prepared in a water-bath to the consistence of an ointment with almost equal parts of oil or fat).[1]

Apart from the fats as a basis, the most varied medicinal substances are mixed with ointments and plasters, and employed successfully upon the skin. A prominent part is played by the metallic oxides and salts, especially (in addition to those of lead) oxide of zinc, subnitrate of bismuth, mercury, sulphur, iodine, narcotic substances, etc.

Unna has recommended recently a new form of application of medicinal substances with fats in which mull fabrics impregnated with ointment mixtures are employed as bandages to diseased parts. This method, which is constantly being improved, appears to be suited for extensive employment.

The special peculiarity of another series of curative measures, of which tar is a representative, appears in the main to be an effect upon the epidermis and the process of cornification, indirectly also upon the vascular and nervous apparatus in the corium. It is well to discard coal-tar, and the impure varieties of wood-tar, the empyreumatic constituents of which act as an irritant, and to employ only distilled wood tar (beech, birch or juniper tar). As a matter of experience, these produce a diminution of excessive formation of scales, diminution of hyperæmia, especially venous, and thus of chronic infiltration of the skin, finally a striking relief of pruritus and, in this latter respect, often exercise the most surprising effect.

I regard their application as most effective when they are employed pure, *i. e.*, without admixture with fat, soap, especially without any addition of alcohol.

Tar should be applied in very small quantities, with a strong bristle brush, and then well rubbed in. Applied in large quantities, and upon parts of the skin which are very congested, sensitive, and contain much exudation, it does not act favorably, and may even produce violent reaction.

Like tar in its action, but not equal to it in efficacy, are carbolic acid, creasote, salicylic acid, benzoic resin, chrysarobin, pyrogallic acid, naphthol, a few mercurial preparations (ung. præcip. album, solution of corrosive sublimate and sublimate collodion), also occasionally sulphur (sulphur flowers, precipitated sulphur, sulphide of calcium and potassium[2]), and finally a few resins (balsam. peruvianus, storax liquidus, oleum roris

[1] Experience has taught that the employment of oxide of lead in this manner, even for a long time and over extensive surfaces, never produces toxic symptoms. I have never observed lead colic or the like, among the many eczematous patients treated in this manner. This is true in a similar manner of the emplastrum hydrargyri.

[2] Upon an acutely inflamed skin, sulphur always produces an increase of the infiltration and exudation, as well as increase of the subjective symptoms. As a rule, however, sulphur acts admirably upon the subjective as well as objective phenomena, as soon as the acute inflammatory process deeper down has run its course or diminished considerably, but the disease of the upper layers has developed more markedly (scaly forms of skin diseases of all kinds, anomalies of glandular secretion, mycoses). In chronic skin diseases of all kinds, Hebra has recommended a solution of sulphuret of calcium (according to Vlemingkx-Schneider) (℞ Calcis vivæ, libram; Sulf. citr., libras

marini). The last-mentioned group, which is characterized by its strong odor, in addition to its action on the continuity of the horny layer, is employed successfully, either alone or in combination with sulphur, soap, and the like, against the parasitic animals and plants which have their habitat in the horny layer, and are not merely situated temporarily on it.

The various caustic remedies serve for the destruction of morbid products and for irritation.

These include: the organic and mineral acids (nitric, hydrochloric, sulphuric, acetic acids, chromic acid in substance); nitrate of silver; caustic potash.

Vienna caustic paste (potash and lime in equal parts rubbed with alcohol and the paste applied the thickness of a knife-blade within a wall made artificially of adhesive plaster).

Chloride of zinc paste, as Landolfi's paste (with chloride of bromine and chloride of antimony); or in sticks (moulded with nitrate of potash 1 : 0.4–0.2 according to Koebner).

The various caustic preparations of arsenic, Dupuytren's powder,[1] Hebra's arsenic paste,[2] pulv. Cosmii ,[3] Marsden's,[4] and Esmarch's[5] paste;

Glycerin iodide;[6]

Corrosive sublimate, alone or with collodion;

Plenck's solution.[7]

Liquor Bellosti (hydr. nitric. oxyd.); finally, the actual cautery, galvano-caustic and thermo-caustic apparatus.

An important part in recent therapeutics of the skin is played by mechanical treatment by means of Volkmann's spoon, the sharp and pyramidal prong fastened to the spoon (Auspitz), and the flat, double-cutting lancet-needle for cutting out vessels in the skin; the various snapper-like apparatus for the same purpose, finally the electrical needles and combinations of needles for the destruction of the hair-follicles, the latter being especially recommended in America in recent times.

In many skin diseases, especially epidermidoses (nævi, pointed condylomata and warts, superficial epitheliomata), in many chronic nodular and pustular formations (acne and sycosis), in acne rosacea, furthermore in certain new formations starting from the corium (lupus tuberculosus and erythematosus), mechanical treatment, either alone or combined with other medicinal agents (for example, caustics in the pricking of lupus nodules, and the like) constitutes a very useful, occasionally (as in sycosis non-parasitaria) the sole therapeutic method, attended with good results.

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duas. Coq. c. Aq. font. libr. 20 ad reman. libr. 12, filtra), also sulphur ointments, mostly in combination with soap and tar. In chronic scaly eruptions of all kinds, also almost exclusively in scabies and mycoses, with the exception of favus which requires more vigorous remedies, I have for years employed a sulphur ointment, combined with storax and soap, according to Weinberg, which has the following composition: ℞ Storacis liq., Flor. sulf. lotor., Cretæ alb. pulv., āā 5.0; Saponis kalini, Axung. porc., āā 10.0; f. ung. This ointment enables me to dispense, as a rule, with other remedies, on account of the rapidity of its action in slight irritation in the above-mentioned pathological processes.

[1] Acid. arsenicos., 0.2; Calomelan., 20.0.

[2] Arsen. albi, 1.5; Cinnabaris factit., 3.0; Ung. rosat., 20.0.

[3] It should be prescribed: Arsenic. albi, 1.0; Cinnab. factit., 35.0; ft. pulv. It should be prepared with gum water.

[4] Arsenic. albi, 10.0; Gummi acaciæ, 5.0.

[5] Morph. mur., 0 25; Arsen. albi, 0.25; Calomel., 0.12; Sacch. alb., q. s. ut f. pasta.

[6] Iodin., Potass. iodid., āā 2.5; Glycerini, 5.0.

[7] Hydr. subl. corr., 2.5; Spir. vini, Acet. vini conc., āā 25.0; Camphor, Alum, Cerussæ, āā 2.5. Ft. pasta.

With regard to internal remedies, I will merely make a few remarks concerning arsenic, atropine, pilocarpine, and a few other alkaloids.

The internal or hypodermic use of arsenic has been highly praised in the treatment of carcinoma of the skin, lupus, psoriasis, and lichen ruber.

There is no doubt that arsenious acid influences the nutrition of the skin, as is shown in arsenic eaters, and in horses to whom arsenic is given in order to make them fatter and the skin more glossy.

A number of alkaloids, particularly ergotine, pilocarpine, and atropine, have been recently used with success in the treatment of angioneuroses and neuroses of the skin.

Finally, a few words concerning the beautifying of the skin.

1. A healthy integument is not necessarily beautiful. Even if all requirements concerning diet, residence, atmospheric and climatic conditions, etc., are carried out, the complexion is often extremely bad. The general condition of health has no influence on the beauty of the complexion, though it has upon the health of the skin.

2. Cleanliness is a *sine qua non* of the beauty of the complexion, though it does not play a great part in the health of the skin.

3. Water is serviceable to the skin only in moderate amounts and at moderate temperatures. Very cold or warm baths, when used to excess, diminish the elasticity of the skin and its power of resistance to external irritants.

4. Distilled and so-called soft water are more suitable for washing and less irritating than hard water.

5. The hard soda soaps are usually preferable to the softer potash soaps for toilet purposes. The quality of soaps depends upon the quality of their constituents and the thoroughness of the saponification. Good soaps must not contain free alkali, or any foreign, irritating substance. The addition of moderate quantities of perfumes does not materially change the quality.

6. Simple, finely ground powders, such as starch, magnesia, etc., are entirely innocuous and often act as a useful protection against external irritants.

7. Frequent application of alcohol abstracts the water of the skin, makes it dry and brittle, and impairs its nutrition. This is also true of glycerin. All toilet washes containing alcohol to any considerable extent should be avoided.

8. This is true to a still greater extent of other additions to washes, such as corrosive sublimate, mineral acids, certain metallic salts, etc.

9. Camphor acts merely as a bleaching powder. This is also true of benzoic resin, sulphur flowers, and substances containing tannic acid.

10. The use of sweet smelling oils and fats should be employed to a greater extent than is now done for toilet purposes.

11. This is particularly true with regard to the growth of the hair. The nutrition of the scalp should be increased by the rational application of fat (for example, in the form of oil-baths by means of the application, at night, of a sponge soaked in oil upon the scalp), and the greater use of simple pomades; this should be applied to the roots of the hair, rather than the shafts.

12. Substances should be avoided or sparingly used which abstract water from the skin and the roots of the hair.

# HYPERÆMIÆ, ANÆMIÆ, AND HEMORRHAGES OF THE SKIN

BY

PROF. ERNST SCHWIMMER.

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## HYPERÆMIÆ.

By *hyperæmia* is meant that transient or continued condition of the entire system or of single parts, in which the blood-vessels present either an excessive accumulation of blood or its actual superabundance. Excess of blood in single parts is only a partial manifestation of general congestion; the former constitutes *hyperæmia* proper, the latter *plethora*. In both cases, an increased blood-pressure may result either from heightened vascular energy or from diminished resistance in the vessels. Increased blood-pressure causes an influx of arterial blood; diminished resistance produces accumulation of venous blood, and hence we distinguish between *arterial hyperæmia or hyperæmia from fluxion*, and *venous hyperæmia or hyperæmia from engorgement*.

*Cutaneous hyperæmia* is made known by visible alterations in the integument. The congestion extends to the vessels inclosed within the layers of the corium, and in some places to those of the subcutaneous connective tissue. It affects a larger or smaller area, according to the causal conditions, and leads to changes in the color of the skin.

These forms of congestion are also known as active and passive hyperæmia; *active*, when the blood-vessels undergo an enlargement, and their contents are propelled more rapidly; *passive*, when, in consequence of obstacles, the flow is retarded. These terms correspond to the mechanical conditions, though we regard the division of the hyperæmiæ into those from fluxion and those from engorgement as physiologically more correct, for strictly speaking, every congestion constitutes a passive condition, since only enlarged vessels are capable of containing a surplus of blood, while every contraction of arteries or veins produces an active condition, in which a diminished blood-supply always results from a shrinkage of the vascular lumen. Consequently, also, a precise distinction between hyperæmiæ arising from an increase of arterial blood, and those due to an incomplete emptying of congested veins, though warranted by science, is of little practical importance. In the majority of cases, however, the fluxion-hyperæmiæ are distinguished

from those of engorgement by certain signs. Arterial fluxion is accompanied by increased rapidity of circulation, which imparts a ruddier hue to the integument. In venous engorgement, the oxygen of the blood, by reason of retarded circulation, is absorbed in greater quantity, making the blood darker and giving to the skin a deep-red or bluish color. A quickened arterial current will communicate the specific heat of the blood, which probably is considerably increased by friction with the walls of the vessels, to the surrounding tissues, and hence the hyperæmic skin becomes warmer, while, in cases of engorgement, the slowly-flowing and imperfectly oxygenated blood loses its specific heat and causes the tissues to appear cooler.

The *symptoms* of cutaneous hyperæmia correspond at the outset with the indications just given; sometimes the earliest sign is the heightened color of the skin; sometimes this is combined with an elevation of temperature. Through continuous operation of the underlying causes, slight swelling occasionally develops, and there may be an unimportant functional disturbance. The phenomona, therefore, are in part analogous to those occurring in inflammation. Pain is often entirely absent, especially when the disease affects large cutaneous surfaces, and is frequently felt only as a sensation of pricking, burning, etc. All the symptoms mentioned may endure singly or in combination for a longer or shorter time, without giving rise to any important disturbances, although they serve as starting-points for the sequelæ of hyperæmia. To this class belong the exudative and hemorrhagic processes.

*Exudation* takes place when the hyperæmia is essentially increased by increased lateral pressure in the blood-vessels, and since the tension of the vascular walls is sometimes greater than their elasticity, the enlarged vessels, under this pressure, will permit an escape of plasma. This exudation, if the undue pressure be constantly maintained, may further lead to an increased growth of tissue, *i. e.*, to hypertrophy.

The hemorrhagic sequelæ of cutaneous hyperæmia are met with when, through peripheral influence, *i. e.*, without the action of the heart being directly concerned, laceration of the capillaries takes place, with escape of their contents. Hemorrhagic affections of the integument, which are brought about by increase of the central cardiac pressure, together with diminished vascular resistance, as in cases of the hemorrhagic diathesis, of pyæmia, scorbutus, etc., are altogether independent of cutaneous hyperæmia.

We find, therefore, that hyperæmia shows itself either as a merely transient condition or as the preliminary stages of long-lasting diseases, and that the cutaneous alterations clearly proceed either from repeated attacks of the complaint, or as results of its passage into other affections.

The blood-vessels, as is well known, are acted on by the *vaso-motor nerves*, which originate in the gray substance of the spinal cord (Vulpian), but which may be regarded as taking their departure from the sympathetic ganglia. Besides these, individual, isolated vascular nerve-centres exist (Eckhardt, Stricker), which give origin to similar branches of nerves. The innervation of the blood-vessels is a very extended one, their condition being affected not only by the sympathetic, but also by the brain and spinal cord.

Investigations concerning the points of exit of the vaso-motor nerves have chiefly resulted in explaining the *contractility* of the blood-vessels. Through them we know that all variations in the color and temperature of the skin are due solely to the agency of the vascular nerves. Further inquiry has shown that vascular innervation takes place in two directions, since the vaso-motors effect, not only contraction, but also dilatation

of the vessels, the *vaso-constrictors* acting in the former case, and the *vaso-dilators* in the latter.

The activity of the vaso-constrictors is essentially expended in maintaining the blood-vessels in that state of moderate contraction upon which depends their tonus, *i. e.*, that constant excitation in which the vascular apparatus normally exists, and which, by overcoming the slight resistances met with, permits an equable flow of its contents. The vaso-dilators, the function of which consists in enlarging the blood-vessels—an effect which many prefer attributing to paralysis of the constrictors—are opposed to the action of the latter; when the equilibrium between the action of the vaso-constrictors and that of the dilators is disturbed, and the influence of the latter preponderates, hyperæmic conditions and an erythematous discoloration are produced.

### A. HYPERÆMIÆ FROM FLUXION OR ACTIVE HYPERÆMIÆ.

These are characterized by an increased flow of blood through the cutaneous vessels and more or less redness of the skin. The color varies from pale pink to blood-red, according to the thickness of the cutaneous layers over the affected part. Thus a hyperæmic scrotal integument presents a deeper redness than the sole of the foot when similarly affected, because in the former case a much smaller supply of blood is required by the enlarged vessels than is needed in the latter where the very minute vessels pass through dense and less yielding tissue. These hyperæmiæ may be either diffuse or circumscribed, and present definite clinical types; these may be enumerated as follows:

(*a*) *Erythema.* (*b*) *Roseola.*

(*a*) *Erythema, E. hyperæmicum* exhibits a pinkish or deep-red discoloration, distributed uniformly or in spots and momentarily disappearing under pressure. It runs its course as an acute affection and only assumes the chronic type by changing into some allied form associated with disorders of nutrition. The shape and extent of erythema are quite undefined and irregular; it is usual to include under this designation all spotty formations of the kind just described which are larger than a pea.

(*b*) *Roseola* (*Rosalia, Rose-rash*) is allied to erythema, and consists of circular spots, varying in size from that of a hemp-seed to that of a lentil, and light or dark red in color. The rash follows the course of an acute affection, turning pale or momentarily disappearing under pressure, and like erythema appears either as a hyperæmic condition or as a long-lasting disorder resulting from consecutive alteration of tissue.

Erythema and roseola are, therefore, two closely related types, solely distinguishable by their different configurations; both, so long as they constitute hyperæmic conditions merely, *are to be regarded as symptoms,* and can only be spoken of as skin diseases inasmuch as they often recur persistently without discoverable cause, and without being developed as the result of direct action on the external integument. This explains why the erythemata have been considered as exhibiting both idiopathic or independent and symptomatic or secondary forms, although such a classification is forbidden by the actual nature of these cutaneous affections. When, however, we speak of the erythemata as symptoms, we are but returning to the views of the older dermatologists (Lorry, Bietl, Bateman) who never thought of dividing these diseases according to the principle laid down by Hebra.

The *duration* of erythema is very variable; it often lasts only a few hours, often again for some days, or even for weeks, in cases where the cutaneous hyperæmia recurs frequently, after its chief symptoms have repeatedly subsided.

The *locality* of erythema is important because the complaint, when a symptom of

certain diseases, often manifests a preference for particular parts of the body. Erythema generally shows itself on the trunk as a precursory symptom of severe febrile disorders (variola, morbilli); it occurs both on the trunk and limbs as an effect of certain drugs (quinine, belladonna, etc.), and on the face and other hairless regions, in consequence of emotional disturbances. Sometimes it displays itself more extensively, attacking almost the entire surface as "erythema universale."

The *mode in which it makes its appearance* forms another characteristic of erythema. The change of color always comes on quickly, often suddenly, and this peculiarity led the English writers to apply to it the term "rash," a designation which, rendered into scientific language, has been conferred especially upon the erythema of small-pox.

In the delineation here given, under the heads of *color*, *duration*, *locality*, and *mode of appearance*, of changes undergone by the general integument, may be traced a *correct picture of hyperæmic or congestive erythema*, which, as already shown, is *characterized by active congestion and caused by disturbed innervation of the vaso-motors* (dilatatores).

The Vienna school has regarded these erythemas as congestive in their nature and has separated them from the chronic forms which Hebra considered due to exudation. The correctness of this distinction could only be made out from the standpoint of pathological anatomy—a standpoint which, in the light of our present knowledge of the function of the vascular nerves, no longer affords the same evidence. *The development of erythema is only to be completely explained through the action of the vaso-motor nerves.*

In accordance with the mode of classification adopted in the present work, we shall discuss the subject of *congestive erythema* in connection with the hyperæmiæ, instead of treating it as one of the neuroses (angioneuroses). Although our pathogenetic doctrine differs from that of the current manuals, yet this circumstance will in no wise interfere with an adequate presentation of our theme in its clinical aspect; and, our point of view being thus made plain, we proceed at once to describe the various forms under which hyperæmic erythema is encountered.

(*a*) *Erythema Caloricum.*—The elements that surround us may, by reason of their very high or low temperature, give rise to hyperæmic conditions attended perhaps by swelling of the cutis with more or less copious exudation. Hot or cold baths may produce such forms of erythema which quickly subside when their causes cease to operate. Another variety is *solar erythema*, a simple and brief hyperæmia, only dangerous when associated with insolation. It affects only those parts of the body which are habitually kept uncovered; it is dangerous when occurring in the scalp, as it is then accompanied by cerebral symptoms, resembling an acute and fatal attack of meningitis.

According to medical reports from tropical countries, erythema is often wanting even in the severest and most rapid cases of insolation; on the other hand, inflammatory erythema, erysipelas, etc., not seldom constitute its attendant cutaneous lesions. *Treatment* of erythema caloricum should be purely expectant. Should the symptoms seem disposed to linger, cold ablutions and the application of rice-powder or fresh grease may be of service. When accompanied by insolation with cerebral symptoms, antiphlogistics must be resorted to.

(*b*) *Erythema ex profluviis* (intertrigo).—The skin may be reddened and even inflamed by long contact with different seretions which are not in themselves injurious, but have been decomposed by exposure to the atmosphere and thus converted into cutaneous irritants, like urine, mucus (especially from the genitals), diarrhœic stools, etc. Women affected with leucorrhœa are very liable to be troubled in this way; likewise little girls who suffer from vaginal discharges, in which cases the symptoms are not to be

attributed to contagion, although they frequently include inflammation and swelling of the labia. Infants, in the earlier months of life, who are not carefully cleansed after evacuations of the bowels and bladder, frequently exhibit this form of erythema. In the case of older children with delicate constitutions, a thin skin of fine texture favors the development of these complaints. Cutaneous irritation and erythema are often produced around profusely suppurating wounds by the action of the discharges. That form of erythema, known as *intertrigo,* which is often called forth in adults by local perspiration, and in children and invalids by neglect of cleanliness, results primarily from constant contact of the irritating substance with too closely-apposed cutaneous surfaces.

Intertrigo frequently persists only a short time as an erythema, changing, if the perspiration which gave rise to it becomes constant and excessive, into an eczema. Atmospheric air being prevented from reaching the affected parts, their originally acid secretion becomes alkaline, and irritates the sensitive integument.

The cutaneous surfaces liable to intertrigo are: those at the angle formed by the ears and scalp; the inguinal region, especially in corpulent adults; the skin beneath the mammary glands in women, or a pendulous abdomen in either sex.

The *treatment* of this variety requires strict cleanliness, diligent washing with pure water, or, if this is not well borne, the application of zinc or lead ointment. Tillaux[1] remarks very correctly that even the use of simple cerate may give rise to inflammatory symptoms. The antiseptic dressings at present in vogue are also capable of exciting erythema. Attention must be paid to these circumstances, if we would understand the inveterate character of such forms of erythema, and their liability to pass into chronic maladies. In many cases, it will suffice to sprinkle the affected surfaces with pulv. amyli, pulv. oryzæ. Fomentations of aqua Goulardi, diluted with equal parts of water, are of great service. These, however, must be used perseveringly until the erythema has gradually but completely disappeared.

(*c*) *Erythema traumaticum* (Hebra) is that form which is produced by simple mechanical causes whenever the surface is subjected to constant pressure from sitting, lying, the wearing of tight garments, bandages, etc. The hyperæmia will continue so long as the irritation is kept up. If the latter becomes more intense and unintermitting, stasis and exudation will arise, and the hyperæmia from fluxion will be succeeded by a state of engorgement. To the same class belong those cutaneous discolorations which are caused by gravitation of the blood toward dependent parts, especially in severe and protracted complaints which compel confinement to a recumbent posture; the pressure then acts locally as a passive force, since the skin suffers injury wherever the patient's couch comes in contact with projecting points of his anatomy. Such erythemata may result in further disturbances of circulation, with production of bed-sores and gangrene.

Hebra rightly lays emphasis on the fact that those parts most commonly affected by erythema seem also very liable to the attacks of other cutaneous diseases. For instance, in shoemakers and tailors suffering from scabies, the greatest number of pustules and nodules, owing to the sedentary nature of their employment, are situated on the buttocks; in women with small-pox, the eruption is more abundant on the parts where their clothes are fastened, *i. e.*, about the waist and below the patella.

(*d*) *Erythema from Psychical Causes.*—This constitutes the type of a physiological angioneurosis. The hyperæmiæ due to such influences are denominated *erythema pudoris,* etc.; they include those sudden flushes that arise from joy, terror, and the like.

[1] Bulletin de Thérapeutique, t. 71, p. 273.

It must be supposed that the vascular centres, as a result of these mental impressions, effect, through their nervous connections, a rapid dilatation or contraction of the entire vaso-motor apparatus, which produces an extensive congestion of the cutaneous vessels (hyperæmia). Such conditions are of brief duration.

### B. HYPERÆMIÆ FROM ENGORGEMENT OR VENOUS HYPERÆMIÆ.

*Congestions arising when any system of vessels becomes opposed to the regular flow of the blood-current by increasing the amount of resistance it has to overcome are called hyperæmiæ from engorgement.*[1] Such a vascular stasis results in a retardation of the blood-current in case no sufficient outlet for the impeded flow is provided by the collateral branches, and hence the fact of retardation is what distinguishes this species of hyperæmia from that produced by fluxion.

The venous hyperæmiæ present spots of *dark-blue, grayish-blue,* and even *reddish-black*, which turn pale, but do not always completely disappear on pressure. Usually these spots soon fade away, yet they frequently give rise to more profound disturbances with sequelæ in the shape of exudations and hemorrhages. The hyperæmiæ from engorgement do not occur in the same way as the active hyperæmiæ, nevertheless it is not always possible to distinguish precisely between the two conditions.

We therefore classify as venous hyperæmiæ those forms in which, through disturbances in the cutaneous circulation, the venous anastomoses experience an accumulation of blood which becomes outwardly apparent. Such engorgements may result from mechanical or from cosmical influences. Among the former are included the symptoms produced by long-continued pressure or friction; among the latter, those due to the surrounding elements, water and air.

(*a*) *Venous Hyperæmiæ from Mechanical Causes.*—Whenever continuous pressure is made upon the skin, whether by a tight bandage or closely-fitting garments, we find in the underlying integument a turgescence of the veins, sometimes with partial œdema. This is observed with especial frequency on the lower extremities, where the force of gravitation exerts no inconsiderable influence over the distribution of the blood. If the reflux of venous blood is persistently impeded, the veins become enlarged, and show through the skin like more or less twisted cords, as in persons who are obliged to stand continually (cooks, bakers, turners, etc.). Individuals of sedentary habits, as clerks, literary men, etc., exhibit a similar telangiectasia of the pelvic organs (hemorrhoids).

Auspitz[2] has investigated very thoroughly the subject of the discoloration which takes place in passive hyperæmia. His numerous experiments resulted in reproducing the various deeper shades, from the cyanotic to cinnabar-red. They proved that these dark hues are owing to the escape of the coloring matter of the blood along with its pressed-out serum. The coloring matter is forced out at the edges of the compressed part, while the centre of the later becomes paler, because at the same time individual blood-vessels filled with serum are prevented from circulating.

In some diseases (typhus, severe pneumonia, fracture, etc.) in which patients scarcely change their positions during long periods, the blood likewise accumulates in the most dependent parts. This is more likely to occur where the skin lies close to the

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[1] In cases of impediment to the blood-current, we know that the arteries which pursue a peripheral course are better enabled, through their *collateral* connections, to compensate for all irregularities of resistance than are the veins which run directly to their centre, the heart.

[2] "On Venous Engorgement," Vierteljahrsschrift f. Dermatolog., 1874.

bones in consequence of loss of fat or muscular atrophy, as over the sacrum and the scapulæ, in which situations bluish-red or dark-blue spots will be presented. These gravitation hyperæmiæ are named hypostases. They constitute another cause of decubitus with subsequent destruction of the soft parts.

(*b*) *Hyperæmiæ from Cosmical Influences.*—These include cutaneous discolorations due to the action of cold water or cold air. When the skin is subject to such influences, a contraction of the minute vessels takes place, and prevents here and there the emptying of the capillaries. If the cold continues to operate, but with less energy, signs of engorgement become apparent, and the skin remains cool and blue until the temperature of the medium has become high enough to produce an equilibrium between the internal and external conditions. The next result is an enlargement of the vessels, which enables the retarded blood to pass off more easily, and the skin resumes its normal appearance. If the cold is sufficiently intense, the parts lose their sensibility, and local inflammatory symptoms set in, which may terminate in mortification and sloughing.

(*c*) *Venous Hyperæmia from Pathological Causes.*—Under this head, we include all states of engorgement from diseased conditions which are characterized by a dark or cyanotic color of the skin. As already remarked, this dark hue is produced by an excess of carbonic acid in the blood, which again is the result of a retarded circulation from pathological obstacles. The more distant the affected part from the heart, and the slower the passage of blood, the deeper is the cyanosis and the larger the extent of surface involved. Sometimes only the tips of the fingers and toes, sometimes also the nose, cheeks, and eyelids exhibit this deep-blue appearance. This variety of hyperæmia forms an essential symptom of *local asphyxia,* the precursor of the so-called *symmetrical gangrene of the extremities.*

These cyanotic alterations of the skin occur most speedily in diseases where, as in croup and œdema of the glottis, the entrance of air is greatly obstructed. When exudation takes place in the respiratory organs, as in pneumonia, pleurisy, and tuberculosis, the same hyperæmic condition is developed much less rapidly. Diseases of the heart sometimes give rise to cyanotic phenomena, though likewise by slow degrees, the retardation of the circulation being manifested by sanguineous engorgement in the great vessels.

Finally, we have to mention a disease that is characterized by a dark-blue color of the entire cutaneous surface—*cardiac cyanosis, morbus cæruleus.* The more common causes of this disorder are patency of the foramen ovale; absence or incomplete closure of the septum ventriculorum; origin of the aorta in the right ventricle; origin of the aorta in the right ventricle, while the pulmonary artery springs from the left ventricle. Occasionally, however, cyanosis does not result, despite the existence of the anatomical anomalies; they are then first brought to light by an autopsy.

It is unquestionable, therefore, that cyanosis is not caused by a mingling of arterial and venous blood, but can only exist when, in addition to the influences just mentioned, a venous stasis takes place into the capillaries. This explains why cardiac cyanosis occurs under precisely the same conditions as all other venous hyperæmiæ.

The *treatment* of hyperæmiæ from engorgement must usually be directed to the removal of the obstacles to circulation. Medical skill is helpless in cases of congenital malformation of the heart; yet *hypertrophy* of the right ventricle, in individual instances, is Nature's own contrivance for the alleviation of cyanosis. Notwithstanding congenital defects in the cardiac structure, cyanosis frequently does not show itself on the skin until the later years of life. Thus Peter Frank relates that he saw a case of

cyanosis in a man which did not come on till he was fifty-seven years of age. I know a girl fifteen years old, of healthy parentage, in whom the symptoms of cyanosis first appeared in her fifth year. The slightest emotional excitement causes the skin of her face to turn deep-blue, while at all other times only the end of the fingers and toes, the tip of the nose, and borders of the lips are discolored. Examination of the heart reveals no valvular defects nor any disturbance of its chief normal relations.

Forster[1] long ago attempied to improve the condition of the highly carbonized blood in this disease by supplying it with an increased amount of oxygen through the administration of chlorate of potash, and he claims to have effected considerable amelioration in individual cases. He obtained still better results from the prolonged use of *hyperoxide of hydrogen,* 8 drops in cod-liver oil, three times daily.

## ANÆMIÆ OF THE SKIN.

This title includes those disorders of the integument which result from a diminution in the entire volume of the circulating fluid. Strictly speaking, it would be more correct to use the name oligæmia in this connection, since anæmia properly signifies an absolute poverty of the blood, whereas we are here concerned merely with a lessening of its amount, which may be either partial or extensive. Virchow first denominated the former condition *ischæmia*, a term which has undergone the same transformation as anæmia. The latter we shall employ as denoting a decrease in the quantity of blood, since such decrease exerts a special influence on the bodily relations and on the color of the skin.

The lessened quantity of blood may either be the direct result of frequent losses (hemorrhages), or it may occur indirectly as a consequence of insufficient formation of blood. The blood-corpuscles may either be actually reduced in number (oligocythæmia), or they may undergo such a change that the relative number of white corpuscles is considerably increased (leucocythæmia). The immediate result of all these alterations is the insufficient nourishment of the vessels and a morbid change in the tone of the general system, which manifests itself on the *outer integument*. The pale, earthy complexion, the yellowish hue of the skin, the loss of color in those parts, as the lips and cheeks, which, in a state of health, are marked out by their roseate tinge—are all characteristic signs of cutaneous anæmia.

Cutaneous anæmia impairs the nourishment of the tissues and lowers the physiological condition of the skin, and it is easily perceived that a continuous decrease in the elements essential to the normal functional activity must be followed by further deviations from a healthy standard, as well as by various incidental disturbances. Such conditions arising from anæmia lead to decay of the tissues, to partial *atrophy*, and if the supply of blood be entirely cut off, to local death—*necrosis*. Hence it follows that, although anæmia may occasion destruction of tissue, yet, since a negative idea is included in its very definition, it cannot give rise to any series of abnormal phenomena more important than those just mentioned. *Consequently, also, cutaneous anæmia produces no diseases of the skin;* it presents itself only as a symptom of general disturbances of nutrition.

Any deficiency in the quantum of blood required for the maintenance of functional activity lessens the supply of nutritive material to the layers of the cutis, so that the

[1] Dublin Med. Journ., 1863, p. 112.

restoration of their wasted substance is very imperfectly accomplished. The immediate results are a dry and brittle state of the epidermic layers, and if the abnormal influences continue, the detachment of thin transparent lamellæ which can be rubbed into a fine powder or into bran-like particles between the fingers. The surface of the skin affected in this way has a dead, lustreless appearance, and when the hand is passed over it, imparts a sensation like that caused by stroking cloth "against the grain." These alterations occur on all parts of the body, but most conspicuously on the extremities; one such morbid condition, characterized by deposits of thin scales, is called *pityriasis*. Besides *paleness* of the skin, its *reduced temperature* is an essential symptom of anæmia.

The *pallor* always proceeds from deficient injection of the cutaneous capillaries. It is often distinctly marked only on isolated parts, and shows more plainly when the local relations give rise to a partial retention of the blood. Similar ischæmic conditions may originate from diseases of single portions of the vascular walls, since, through mechanical pressure, as from bandaging, a narrowing of their calibre may take place, with paleness of the skin only in particular localities.

*Local pallor* is often witnessed as a result of profound destruction of the general integument, with subsequent cicatricial growth (lupus, scrofulosis, syphilis); the skin becomes pale and bloodless, since the cicatricial changes in the connective tissue produce here and there obliteration of the vessels; the latter, however, more frequently disappear completely, and minute veins become visible on the newly-formed epidermic surfaces – signs of a partial new-formation and restored communication with the surrounding capillary plexuses; the pallor is also frequently influenced by the coloring-matter of the blood. When the latter is deficient, the anæmic skin assumes a yellowish-white appearance; where it is more abundant, a darker shade is produced.

The duration of cutaneous paleness varies greatly. When the anæmia is caused by loss of blood, the pallor is extreme and persistent; when vascular nutrition is imperfect, as in oligocythemia and leucocythemia, the skin is pale, but not as yellow as in the former case; carcinomatous and tuberculous subjects present a waxen hue; and all these different abnormal appearances remain so long as the original disease continues.

Cutaneous pallor is not only to be regarded as a diagnostic indication, it also constitutes an *aid to prognosis*. In this respect, the cutaneous symptoms belonging to the acute exanthemata (scarlatina, measles, and the first stage of variola) are of no small value, and we are frequently admonished of severe internal complications by the pallor which attends the progress of these complaints. The same remark applies to other diseases, as typhoid fever and cholera. In all these cases, the supply of blood which should normally be retained by the integument is withdrawn from it for the support of morbid processes in the system at large, and as the condition of the latter deteriorates, the small vessels which nourish the skin collapse, and visible anæmia is the result. Hence, the more decided this collapse, during the course of eruptive or other infectious maladies, the more unfavorable is the prognosis, and in this way the state of the skin alone may serve to measure the intensity of diseased conditions.

The *fall of temperature*, that other constant symptom of cutaneous anæmia, is rendered evident in various ways. As a subjective sensation of cold it is perceived most plainly on the parts furthest from the heart. The ears, the nose, and the ends of the fingers and toes become pale and cold. Anæmic patients frequently complain of chilliness in the skin, and the latter in this case becomes shrunken, owing to contraction of the smooth muscular fibres; in like manner, the cold stage of ague is accompanied by transient cutaneous anæmia. Disturbed innervation from emotions of indignation or of joy, or in consequence of insufficient assimilation, as through hunger or fatigue, pro-

duces not only pallor, but a sensation of coldness in the skin. Sometimes this is accompanied by a diminution of tactile sensibility, which may even amount to positive anæsthesia.

The *treatment* of cutaneous anæmia must always be conducted with reference to causal conditions. If we can succeed in compensating for the loss of blood, or in improving the insufficient hæmatosis, we shall be enabled to remove both the internal symptoms of anæmia and its superficial manifestations. The indications for the management of the general affection belong to the department of special pathology; as to cutaneous anæmia, we will merely observe that the best means of arousing the blood-vessels to renewed activity is by *friction with pure water or alcoholic solutions*. If the blood-supply is impeded through predominance of vascular contraction, moist heat in the form of cataplasms, baths, etc., will prove most effective in relieving the circulation and restoring the natural color and temperature of the skin.

## HEMORRHAGES OF THE SKIN.

The term *hemorrhage* is used, in a general sense to denote any condition of the vessels accompanied by an escape of their contents. In consequence of the well-known firmness and elasticity of the vascular apparatus, hemorrhage is impossible except through some alteration or defect in the structure of the vessels. The bleeding may be either *internal* or *external*. The former class includes hemorrhages of the internal organs and cavities; the latter those proceeding from visible mucous surfaces or from the general integument.

Extravasation into the cutaneous tissue assumes several forms, which have been named as follows:

1. *Petechiæ*, when the effused spots are as large as poppy or hemp seeds or as peas, and of a red or dark-blue or bluish-red color; *stigmata*, when they are the size of a millet or of a lentil.

2. *Vibices*, when they appear in streaks.

3. *Ecchymoses*, when they form blotches varying from the size of a pea to that of the palm of the hand; and

4. *Ecchymomata* (boils), when the hemorrhage at the cutaneous surface gives rise to a tumefaction.

These various effusions into the cutaneous tissue are characterized by the fact that, with the exception of the boil, *they do not rise above the level of the skin; they turn pale, but do not disappear under pressure; and fade away by degrees, the skin resuming its natural appearance.*

The *hemorrhagic papule* and the *hemorrhagic vesicle* are examples of hemorrhage combined with exudation, rather than true extravasations. That variety of hemorrhage must also be mentioned in which pure blood is effused upon the surface, without lesion of the vessels themselves. This peculiar condition, known as *hæmidrosis*, being merely a sanguineous effusion which takes place through the excretory ducts of the sudoriparous glands, belongs to the anomalies of perspiration.

*Condition and Symptoms of Cutaneous Hemorrhage.*—The causes of hemorrhages of the skin are of various kinds, yet these accidents can only take place as results of the following changes within the vascular system:

1. *Through Rupture of the Vessels* (extravasatio per rhexin).—This occurs either

from external violence, or through some internal influence which gives rise to a considerable increase of blood-pressure and an effusion into the integument (suffusion and suggillation).

2. *Through Vascular Degeneration* (extravasatio per diabrosin).—This causal condition operates in cases of internal hemorrhage from atheromatous or other diseases of the vascular system, even more frequently than when it results in cutaneous hemorrhages; moreover, a similar state of the vascular walls is produced by a loss of cutaneous tissue substance due to scrofulous, syphilitic, and other forms of ulcers.

3. *Through Transudation through the Vascular Walls* (extravasatio per diapedesin).—This occurrence was recognized by some of the older authors, who supposed that an actual secretion of blood took place through the vascular walls, but this idea was afterward rejected as unsusceptible of proof.

Stricker[1] was the first to demonstrate the passage of blood-corpuscles through the capillary walls, and his conclusions were soon fully confirmed. The occurrence itself was accurately studied on the nictitating and web-membranes of the frog; it arises from the manner in which the corpuscles of the capillaries sometimes adhere to the walls of the latter, and here and there penetrate their finely porous structure; vascular contractility, likewise, occasionally contributing to the same effect. Such a process, obviously, can take place only in capillaries provided with very delicate adventitia.

Extravasations of the above-named descriptions into the cutaneous tissue give rise to various alterations of color (spots), owing to a deposition within the cutis either of the blood itself or of its individual elements. In the former case, the color of the corpuscles will predominate, and the spots will appear of a light or dark red (purplish) tinge; in the latter, however, and also if a certain length of time has elapsed since the occurrence of the hemorrhage, the discoloration will be produced by pigmentary material which has been separated from the blood. Thus, from the *hæmatin* originate those variously colored crystals—viz., the yellow or ruby-red (*hæmatoidin*), the dark-brown (*hæmin*), and the bright-red (*hæmatocrystallin*)—which impart the familiar hues displayed upon the skin as a consequence of contusions.

## HISTORY.

Werlhof was the first[2] who made cutaneous hemorrhages the subject of a special delineation. Werlhof separated the hemorrhagic spots appearing in the course of typhoid and other dangerous febrile conditions, and called petechiæ, febris petechialis, from another, non-febrile form of purpura which he denominated *morbus maculosus hemorrhagicus*. Werlhof's classical edifice was almost completed by Wichmann on its diagnostic and therapeutical sides; and in like manner his views were partly accepted, partly modified by many later authorities,[3] until the English dermatogists, Bateman, Willan, and their followers gave them the form which, until quite lately, they have since retained. More recently, Schwediaur[4] substituted for "purpura" the term eeliosis, which was employed in the same sense by Alibert and Schönlein.

This conception almost universally prevailed, and the distinction between petechiæ

[1] Sitzungsbericht d. Kais. Akademie, Bd. 52. Prussak, Sitzungerber., Bd. 56. Hering, ibid., Bd. 57.

[2] Werlhof, Opera Medica, Hannoveræ, 1775, and Wichman: "Ideen zur Diagnostic," 1800, I., S. 98.

[3] Gauthier Bellefonds: "Essai sur la maladie tachetée hémorrhagique de Werlhof," Paris, 1811.

[4] Alibert: "Vorlesungen über die Krankheiten der Haut," 1837, II., S. 432.

and purpura was recognized by both scientific and clinical authorities, until within the last few years.

The majority of recent writers hold to the idea of essentially differing forms of purpura, which, by Reder,[1] Neumann,[2] and Kaposi,[3] are regarded, apart from other varieties as only two in number, viz., *purpura simplex* and *purpura hemorrhagica*. We conceive that this latter distinction is unnecesssary, since cutaneous hemorrhage is included in the very idea of a purpura or a peliosis, and no difference except in degree is to be traced between the hemorrhagic purpura of certain authors and purpura simplex as described by those authors themselves. The following representation of purpura is in accordance with this position. As little should purpura senilis be classed as a separate species, since there is nothing sufficiently peculiar about the occurrence of sanguineous infiltrations on the lower extremities, chiefly of old people.

### DEFINITION AND VARIETIES OF PURPURA.

By *purpura* is meant *a disease accompanied by extravasations into the skin, or sometimes into the mucous membranes, which take the form of dark-red or livid spots or of more extensive hemorrhagic effusions.* It may appear suddenly, *i. e.*, without precursory symptoms, or *in conjunction with rheumatic pains and fever, and may run its course with or without the occurrence of internal complications.* Purpura is not to be regarded as an independent disorder, but only as a symptom of other conditions originating either locally, in the vascular system, or generally, in the blood itself.

Several years ago I drew attention[4] to the peculiarities connected with the essential character and diversified manifestations of purpura, and protested against going too far in separating the varieties thus denominated.

Mollière[5] pronounced purpura to be only one link in a chain of diseased conditions characterized by hemorrhages into the integument and the internal organs, and included under this name, perhaps somewhat too hastily, not only many infectious disorders and articular rheumatism, but also hæmophilia and scorbutus. Not long afterward, Scheby Buch[6] became convinced that hemorrhagic purpura was a frequent accompaniment of articular affections, and that purpura simplex, purpura hemorrhagica, and scorbutus are only different grades of the same complaint. This opinion was founded upon a series of striking and accurately observed facts, by which it was sought to be established that articular affections and scorbutus often go together, and that the unity of all these affections is consequently to be inferred.

The rheumatic nature of many forms of purpura was first pointed out by Schönlein. Traube[7] regarded rheumatic purpura as identical with articular rheumatism, because post-mortem examinations in some fatal cases had shown him extravasation and injection into the joints, while in life no purpura had existed. We shall not here discuss the question whether articular rheumatism be identical with rheumatic peliosis, although a close etiological relation between the two morbid states might perhaps be shown to exist;

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[1] Hebra's "Handbuch der Hautkrankheiten," I., S. 622.

[2] L. c., S. 242.

[3] "Pathologie und Therapie der Hautkrankheiten," Wien, 1881.

[4] "Ueber die hämorrhagischen Affectionen der Haut," Pester Med. Chirur. Presse, 1873.

[5] "Nosografie du Purpura," Annales de Dermatolog., Paris, 1874, p. 44 ff.

[6] "Gelenkaffectionen bei den hämorrh. Affectionen," Deutsch. Arch. f. Klin. Med., 1874, 26. Bd., S. 466.

[7] "Gesammelte Beiträge zur Pathologie u. Physiologie," Berlin, 1871, II., S. 763.

it may be regarded as certain, however, that the rheumatic pains which are observed in many cases of purpura do not belong to the category of purely rheumatic inflammations.

Immermann,[1] likewise, seeks to merge the different varieties of purpura into one common form, and he dwells with special emphasis on the rheumatic symptoms and painful articular swellings which frequently accompany morbus maculosus. Perhaps, therefore, Immermann is only regarding the matter from a clinical standpoint when, although refusing to acknowledge the peculiar position in which rheumatic peliosis has been left by preceding authorities, he nevertheless designates one variety of morbus maculosus as *rheumatoid purpura*, and assigns it a place among the other forms of purpura.

Having decided to contemplate all the morbid processes above mentioned as one united whole, we now go on to treat of the cutaneous hemorrhages as comprehending only two forms, viz., morbus maculosus and scorbutus.

1. *Morbus Maculosus Hæmorrhagicus, s. Purpura Hæmorrhagica (Werlhofi).*

This disease is characterized by the appearance, on almost any portions of the surface, of *dark-red or bluish-red extravasations*, usually only *as large as a hemp-seed or a lentil*, but in severe cases attaining the size of *a bean or of the palm of the hand*. The spots do not come out suddenly, and a certain order of succession is generally observed in their development. In the great majority of cases the extravasations first appear on the upper extremities, then spread to the body and breast, and finally to the lower extremities. In the last-named situation their occurrence is comparatively rare, and is always an indication of serious disorder. According to the majority of authors, hemorrhagic purpura is distinguished from the simple form by the larger extent of surface invaded by the spots, and by accompanying affection of the mucous membrane, together with high fever. This distinction, however, in most of my cases of purpura, I have been unable to trace, having often encountered both violent febrile symptoms accompanied by an unimportant amount of extravasation, and slight general symptoms with strongly marked hemorrhagic phenomena; frequently also there is a disproportionate appearance of extravasation, since trifling hemorrhages often result in considerable effusion or we may have but a small amount of cutaneous hemorrhage, which, however, may develop into the opposite condition, and *vice versa*.

In almost all cases of purpura, the appearance of the spots is preceded by great debility, heaviness in the limbs, general uneasiness, etc.; the pulse is more or less quickened and there is sometimes a constant or an intense fever. A slight decline in these symptoms usually takes place as soon as extravasation sets in. The hemorrhagic spots are uncertain in their period of duration, and, the process of effusion into the skin being an irregular one, they are seen breaking out in many places, while fading away in others.

These alternating phenomena often continue for some time, since the debility which accompanies the disorder is not diminished by the successive sanguineous effusions, and the general indisposition endures almost throughout the whole period of the disease. In a great many cases, drawing and tearing pains, accompanied by general depression and febrile movements, are felt in the joints and in single groups of muscles, before the hemorrhages appear. When these symptoms abate, the extravasations usually make their first appearance on the lower extremities, etc. *An œdematous swelling of individ-*

[1] This Manual, Vol. XIII., 2d half, p. 744.

*ual joints, especially those of the knee and ankle,* now sets in, and is attended with a good deal of spontaneous pain; the œdema, however, seldom proceeds far, and subsides within a few days; at the same time, the rheumatic pains abate, the hemorrhagic spots fade away, and in the course of two or three weeks all the morbid phenomena have disappeared.

*The more aggravated forms of purpura* are either developed from those which commence with a moderate degree of fever, or they manifest their increased severity from the outset. They are characterized not only by a greater number and wider diffusion of the hemorrhagic spots, but also by the development of conditions which may occasion lasting constitutional disturbances. We now find livid ecchymoses from the size of a pea to that of a kreuzer, and irregularly shaped blotches covering several square centimetres and formed by the coalescence of individual spots. Along with these there are extravasations into mucous membranes, and sometimes actual sanguineous effusions into some one of the bodily cavities. In severe cases the tension of the vascular walls throughout the whole system is greatly relaxed, and hemorrhages into internal cavities and parenchymatous organs are the spontaneous result. In this way *sanguineous effusions take place into the stomach, the lungs, the bowels, the uterus,* and even into *the arachnoidal cavity.* Of course, such complications may lead to a fatal issue, yet this is seldom the case.

When purpura is complicated with severe constitutional symptoms, and marked by a large amount of cutaneous extravasation, the results of great losses of blood will soon be apparent. Such patients present a decidedly anæmic appearance, their blood is poorly supplied with solid constituents, and symptoms of hydræmia supervene, through which the complaint may be protracted and many subsequent ailments be produced.

*The duration of purpura* cannot be precisely fixed. In many cases the disease continues for only a few days (eighteen to twenty), in others again for several weeks, and it has even been known to last for months and years.

### (*b*) *Purpura scorbutica; Scurvy.*[1]

The symptoms of scorbutic purpura point to the existence of a blood-dyscrasia, and this disease may be regarded as the true representative of a general morbid state, arising from dissolution of the blood, and localized on the cutaneous surface. The appearance of extravasations on the skin is always preceded by general lassitude, with pains in the extremities and different joints; there is often only moderate fever, which endures for a longer or shorter time according to the form of the disease. The purpuric spots usually appear first on the lower extremities, they spread thence over a great part of the body, and in malignant cases increase to extravasations as large as a dollar or as the palm of the hand, which in some places change into ulcers with a discolored sanious border. *An unfailing symptom is the affection of the gums;* they become inflamed, painful, swollen, and subject to spontaneous hemorrhage; the teeth loosen and fall out easily; moreover, effusions of blood or serous exudations may take place in other mucous membranes or in internal organs, where they constitute in many cases a direct cause of death.

Scorbutus is the most dangerous form of purpura, and the accompanying cutaneous hemorrhages are only one manifestation of the general nutritive disturbance. Fortunately, the disease is now much less prevalent than in former times, when it frequently assumed an epidemic form—the inevitable result of infectious surroundings, unwholesome nourish-

[1] For more extended remarks on scurvy, see this Manual, XIII., vol. 2.

ment, and impure air. These morbific influences operate most injuriously where human beings are crowded together in confined abodes (forts, prisons, hospitals, ships). A distinction (in reality a purely topographical one) was hence drawn between *land-scurvy* and *sea-scurvy*. At present, since improved sanitary conditions have so generally resulted from the enforcement of rational hygienic rules, an epidemic of scurvy is comparatively very rare and such sporadic cases as occur are of a much milder type.

### ANATOMY.

The pathological anatomy of purpura is at least more accurately understood than its patho-chemical relations. Rayer[1] stated that the effusions presented different appearances according to their situation among the cutaneous layers, the smallest spots being discovered in the corium, and the largest in the subcutaneous cellular tissue.

Similar results were arrived at by Gustav Simon,[2] who found an accumulation of blood between the corium and the epidermis; he also observed that beneath the more highly-colored spots the deepest layers of the epidermis appeared infiltrated with blood, and that blood-corpuscles were plainly visible in the extravasations. Effusions into the epithelial tissue, as well as secondary hemorrhages into the skin and mucous membranes, were first made the subject of an exhaustive investigation by E. Wagner.[3] According to him, the effused blood lies between the individual layers of the cutis—especially the stratum lucidum, which forms the transition to the epidermis—and the boundary-line of the Malphigian network; the latter, as well as the true corium and the sudoriparous glands, show no trace of extravasated blood. The extravasation itself consists of a compact aggregation of red blood-corpusles which appear embedded in a peripherally-disposed layer of reticulated fibrin.

Wagner was unable to account for the occurrence of hemorrhages into the tissue by the condition of the vascular system itself, since in several carefully observed instances of the hemorrhagic diathesis the epithelium had remained quite unaltered; consequently, he seemed obliged to fall back upon the supposition of an extravasatio per diapedesin, since this led him nearer than any other to a real solution of the problem.

The idea that the cause of cutaneous hemorrhage was to be sought in the patho-chemical state of the liquor sanguinis is one which occurred to some of the earlier physicians. Many of these authorities claimed to have found that the blood of purpural subjects was deficient in coagulability, while others opposed this view.

Andral and Gavaret, as also Bequerel and Rodier,[4] found the liquor sanguinis unaltered in constitution, but of lower specific gravity, in several diathetic affections, as well as in cases of scurvy.

In beleaguered Paris, during the Franco-Prussian war, scurvy was of frequent occurrence, affording unusual opportunities for a thorough study of the disease. Among the numerous and detailed publications on this subject, those of Chalvet are deservedly prominent.[5] He observed that the blood of scorbutic subjects was pale and watery, that the proportion of fibrin in its clot was increased twofold, and that of the red corpuscles diminished; while it contained only trifling amounts of potash and iron. Similar exam-

[1] "Traité des malad. de la Peau," Paris, 1835, p. 520.

[2] "Hautkrankheiten, anatomisch erläutert," Berlin, 1854, p. 77.

[3] Archiv der Heilkunde, Band 9 und 10, 1868 und 1869.

[4] Gazette médicale, 1847, Nos. 25 and 26.

[5] Schmidt's Jahrbücher, 1872, 1. Bd., S. 88.

inations have led other investigators to more or less different results; but, from the present state of our knowledge we are justified in concluding that the composition of the blood in scurvy and purpura is not materially different from that which obtains in other so-called blood-diseases.

### DIAGNOSIS.

The diagnosis of purpura will not be difficult if undertaken with the aid of the foregoing symptomatic picture, and if the cutaneous alterations arising from hemorrhages be duly taken into account, the red or livid spots characteristic of this disease will be easily differentiated from similar phenomena occurring in the course of other exanthemata. An exudation of longer or shorter duration takes place in measles, in the initial stage of small-pox, and even in isolated cases of cholera (roseola cholerica), but it never proceeds to extravasation; the febrile symptoms are always strongly marked, sometimes becoming intense, and the accompanying affections of the internal organs are of a very different nature. In typhus fever, the petechial extravasation is likewise preceded for a lengthened period by quite another series of phenomena, whose nature is sufficiently familiar. Equally unlike purpura is hemorrhagic small-pox, *i. e.*, that peculiar process, dependent upon variolous contagion, which does not give rise to spots and pustules, but through which the disease, almost at a stroke, takes on the form of a diffuse hemorrhagic affection of the skin and mucous membranes. The symptoms of this disorder are of a malignant character from the very beginning; high fever, violent sensorial disturbance, delirium alternating with profound sopor, are accompaniments of the cutaneous extravasation, and are much more sudden and overwhelming in their onset than in purpura—often resulting fatally within a few days. Diagnostic errors may, as we have said, be easily avoided by paying due heed to the constitutional symptoms.

But even non-febrile states may occasionally give rise to errors. In extravasations from contusion, diagnosis would seem to be easy, owing to the small extent of the hemorrhage, the swelling, and the increased sensibility of the parts; yet there is a class of artificially produced phenomena of this kind which it is important that we should be able to recognize promptly. Take, for example, *purpura pulicosa*. It may seem almost ludicrous to make mention in this place of the cutaneous appearances which are caused by flea-bites, since they are of adventitious origin, rather than actual products of disease and are partly hemorrhagic, partly erythematous in their nature, yet we can recall one case in which the body was covered with several hundred flea-bites, and which certainly bore a striking superficial resemblance to purpura. In hospitals and among the very poor such spectacles as this are not uncommun, though seldom presented by patients of a higher class. The peculiar and unmistakable aspect of these subjects, the character of the spots when closely examined, with their central punctures surrounded by an erythematous blush, as well as the marks of scratching which are almost always perceptible, will readily disclose the real nature of the disorder.

### ETIOLOGY.

The causes of purpura are either direct or indirect, and differ in part from those which give rise to hemorrhages in general; ruptnre and atrophy of the vessels must in most cases be excluded, since anatomical examination has revealed no such lesions from purpura in the cutaneous vascular system. The outward aspect of the extravasation, and the bloody infiltration of the different cutaneous layers, would lead us much more readily to infer a transudation of the liquor sanguinis through the elastic walls of the

vessels into the surrounding tissue, as the only possible mode in which the hemorrhagic spots can be directly produced. This explanation, however, presupposes an abnormal condition of the organism, which must proceed either from an alteration in the liquor sanguinis, or from a morbid state of the vascular apparatus; although it is true that no satisfactory explanation can be based either on the incomplete analyses of the blood or on the imperfectly understood relations of the vaso-motor nerves. On the whole, therefore, we incline to the opinion that *a morbid alteration in the liquor sanguinis,* together with *an affection of the vaso-motor nervous system,* constitutes the pathological influence which determines the production of purpura.

In regard to *a morbid condition of the liquor sanguinis,* we have already mentioned that chemical investigations have hitherto led to no conclusions which would justify a positive statement concerning any definite alteration of the blood; still this is far from proving that no such alteration can take place.

As to *a diseased state of the vascular system,* we have few reliable data. Anatomical evidence of an alteration in its structure is indeed wanting; yet there are certain conditions in which a disease of that structure must be presupposed, which exist whenever slight causes give rise to hemorrhages in parts far distant from each other, and which constitute what is known as the *hemorrhagic diathesis.*

In this we observe a diminution in the normal tone and requisite elasticity of the vascular walls, probably dependent on insufficient nutrition of the vaso-motor nerves, or on their paralysis; such a condition must be regarded as a local enfeebled state of the vascular apparatus, which is synonymous with a vaso-motor disease.

This vaso-motor disease, or, more correctly, vaso-motor neurosis, may be caused either by a direct (central) or reflex irritation; though we cannot be certain in every case of purpura to which of these it is due. Under all circumstances, however, the morbific agent which leads to extravasation in the skin or into the internal organs and gives rise to purpura, appears to produce also the vaso-motor neurosis; still, it seems more correct to regard purpura as a trophic affection, and all the indications which might lead us to class it as an angioneurosis point equally to its acceptance as a tropho-neurosis.

Among the indirect causes of purpura are to be reckoned morbific influences of the most varied nature; insufficient and unsuitable nourishment; constant exposure to damp or impure air; mental depression; emotional conditions, as grief, etc., all of which may also lead to changes in the vaso-motor nerve-centre.

Certain drugs sometimes cause cutaneous hemorrhage; thus Tilbury Fox[1] saw hyperæmiæ and sanguineous extravasation produced on the surface by the inhalation of four grammes of tincture of benzoin; Fournier[2] relates that the administration of iodine was occasionally followed by a peculiar kind of purpura—numerous extravasated spots, mostly the size of a pin's head, appearing on some patients every time they took the medicine, and lasting for several weeks. Similar cases have been reported by other authorities, the form of purpura described in all these instances reminding us strongly of the reflex urticarial eruptions produced by certain articles of food. Individual outbreaks of purpura, and especially of scurvy, are undoubtedly attributable to the causes we have adduced, since the appearance of the latter disease in an almost epidemic form may be observed in ill-ventilated and overcrowded habitations, as jails, hospitals, etc., when the dietetic conditions are unfavorable, and in besieged towns under analogous circumstances.

Hayem, during the siege of Paris in 1871, made a careful study of the epidemic of

[1] Lancet, 1874, No. 6.

[2] "Jodisme Petechial," Annales de Dermatologie, Paris, 1877–78, p. 21.

scurvy which then prevailed. He found that the food-supply of the inhabitants, considered not merely as to its quantity, but also and chiefly with regard to quality, exerted a most important influence in bringing about the disease, since not only the meat and wine, but also the vegetables then obtainable in Paris, were far from fresh, and hence were largely deprived of those elements—the potash-salts—most indispensably required for the maintenance of health.

### PROGNOSIS.

This depends upon the character of the symptoms. It is favorable in cases of simple, uncomplicated cutaneous hemorrhage, but when effusions take place into internal organs the complaint assumes a more serious aspect, especially if it breaks out repeatedly upon the skin and is accompanied by high fever. The prognosis is bad when hemorrhages occur in vital organs, as they may become so profuse as to cause a fatal result. The constitution, the age, and the vital relations of the patient must also be taken into account, and the probable consequences of anæmia should never be overlooked when the loss of blood is considerable.

In scurvy, the prospect of recovery is much improved at the present day, since sanitary rules have been based upon a broader and more intelligent comprehension of hygiene; nevertheless, a cure is always more likely to be effected in sporadic than in epidemic cases.

### TREATMENT.

Rational procedures will nearly always insure us a result either partially or wholly satisfactory.

The empirical use of acids, especially sulphuric acid, and of preparations of iron and bark, by some of the older physicians, was attended with success, and this must now be regarded as the only proper method, since the leading indications are, first, to invigorate the vascular structure and restore the nutritive properties of the liquor sanguinis, and, second, to compensate for the loss of blood. In accordance with these principles, we administer, on the first appearance of the spots, Elixir. acid. Halleri 1.0–1.5 grm. pro die, lemon-juice, pure or dissolved in sweetened water; in cases of larger extravasations, Liquor ferri sesquichlorati (1.0–2.0 grm. pro die), Extract secalis cornuti in solution (2.0–2.5 grm. to 100.0 Aq. d.) or by subcutaneous injection (Ergotini, Aq. dest., ana 5.0. D. S., ½ to 1 syringeful twice daily), which last is often of the greatest service. For scorbutic affections of the gums we employ a wash composed of Ext. ratanhiæ (5.0–10 grm. to 300.0 of fluid). The gums are also painted with citric acid or dilute chromic acid (5.0 to 200 solution, Millard). For the debility, quinine and iron in suitable doses, and a generous diet of meat and fresh vegetables, with wine, are best adapted to restore the saline ingredients of the blood, since potash and iron constitute equally important elements in the composition of its corpuscles. In cases of hemorrhage into internal organs, cold applications by means of wet compresses, ice-bags, injections (when they can be made directly into the affected cavities), etc., according to the locality of the effusion; in purpura with rheumatic or articular pains, salicylic acid in the usual doses.

To hasten the removal of the cutaneous spots, we may resort to lotions, though these act only by increasing vascular tension. Tripier observed that absorption was promoted by local faradization, which, however, was unsuccessful when the extravasations were large and scattered over all parts of the surface. When there is marked atony of the skin, especially on the lower extremities, constant pressure by means of roller bandages will also facilitate absorption.

# DERMATITIDES SUPERFICIALES

BY

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We shall class as superficial inflammations, first, those due to thermal, chemical, and mechanical influences, and, second, catarrh of the skin, eczema.

Affections of the former variety present all the signs characteristic of inflammation in general, viz., redness, swelling, heat, infiltration and pain. Like other inflammations also, they terminate either by resolution, by suppuration, or by gangrene.

According to their respective causes, they are divided into :

1. Dermatitis calorica.
2. Dermatitis traumatica.
3. Dermatitis e venenis et causticis.

*Dermatitis Calorica* is subdivided into dermatitis ambustionis et congelationis.

## DERMATITIS AMBUSTIONIS.

### BURNS.

The alterations on the cutaneous surface and in the system at large produced by burns, differ according to the capacity for heat possessed by the substance which inflicted them, the length of time during which the action is kept up, the extent of surface acted on, and the individual susceptibility of the patient. The resulting lesion is the more dangerous, the greater the capacity for heat (*i. e.*, in the case of fluids, the higher their boiling points, and the more they are concentrated), the larger the area involved, and the less the subject's constitutional power of resistance (children).

Burns are caused :

1. By radiant heat (of the sun).
2. By the action of fire (including explosions of gunpowder, illuminating gas, and fire-damp).
3. By direct contact with heated bodies.

According to their degree, they are divided into :

Dermatitis ambustionis erythematosa, bullosa, escharotica.

### A.—*Dermatitis Ambustionis Erythematosa.*

A temperature of less than 60° C. gives rise only to an erythema, which soon disappears after the removal of the cause. At 60° C. and above, inflammation and transudation are produced in addition to redness. The latter is accompanied by considerable pain, and lasts several days; it is confined to the surface first acted upon, and does not disappear entirely under pressure; generally also there is slight swelling.

In the course of a few days the cuticle peels off, and the redness and swelling disappear. There frequently remains a trifling discoloration.

Burns of this degree result in most cases from prolonged exposure to the solar rays, or from the speedier operation of ignited gases and vapors.

### B.—*Dermatitis Ambustionis Bullosa.*

A temperature of 75° to 100° C. gives rise to more pronounced transudation and inflammation. Either immediately or within a few hours, the epidermis rises into blisters and bullæ as large as a hen's egg. These are filled with a thin, limpid serum, which, however, after a time, often attains the consistency of jelly, and is then only forced out by pressure. The serum contains epithelial débris, fibrinous clots, and white blood-corpuscles; it abounds in inflammatory lymph, as distinguished from that of engorgement, and shows but few red blood-corpuscles.

Through increased exudation of serum internally, or in consequence of force applied from without, some of the blisters rupture. The epidermis then lies in white, pulpy layers, or rolls of soft, white membrane, on the bright-red corium dotted with numerous bloody points. The pain is exceedingly severe. The formation of the bullæ takes place between the rete Malphighii and the epidermis. Hence the bullæ are frequently chambered because the transudation, as v. Biesiadecki has shown, draws out the epithelial cells of the Malphigian layer into slender fibres resembling the connective-tissue fibres. In the most favorable cases, the fluid is subsequently absorbed, and the bulla itself collapses, shrivels, and falls off, leaving a red spot covered with delicate epidermis. When the bulla is ruptured, a scab, beneath which cicatrization takes place, is formed by atmospheric action upon the exuded fluid and shreds of epidermis, unless suppuration ensues and protracts the process of healing.

### C.—*Dermatitis Ambustionis Escharotica.*

A high degree of heat, or the continued action of a lower degree, results in the formation of an eschar; this is smooth and white, or ashen-gray, yellow, brown or black; moist or dry; of a leathery hardness; firmly adherent, and without sensation. A section of such an eschar reveals tree-like ramifications, marking the course of carbonized blood-vessels, which are not met with when the injury has been inflicted after death (E. Hoffmann). How far downward the eschar extends cannot be inferred from its external appearance. As the healing proceeds, the eschar gradually sloughs off. It is encircled by an erythematous blush, and on the third to the fifth day, a purulent border (the line of demarcation) makes its appearance. The accompanying pain, which at first is generally very slight, becomes exceedingly severe. The time occupied by this process depends on the size of the eschar. When the latter is confined to the outer integument, it is generally cast off in from ten to twelve days. It is usually succeeded by a group of very painful granulations having an uneven surface. Cicatrization begins at the borders

of the eschar and around isolated portions of healthy epidermis. The resulting scars are generally stellate in shape and reticular in structure, and they shrink during their formation, giving rise to ugly contractures and adhesions. The direct action of flame, contact with molten metals or with caustic lime, etc., are the accidents by which burns of this degree are chiefly occasioned.

The constitutional affections produced by burns are of the greatest importance.

Burns involving one-half of the cutaneous surface are inevitably fatal, while those which cover only one-third are hardly less dangerous. Persons thus injured usually feel comparatively well for the first day; they are lively, and complain only of severe pain. After the lapse of from twenty-four to thirty-six hours, however, they become dull and sleepy; the extremities are cold, the pulse small, and the temperature two or three degrees below the normal, though rising again at the approach of death. The somnolence deepens into insensibility, and in this condition the patient succumbs. In some cases, the closing scene is preceded by great restlessness, clonic spasms, and even jactitation. Oftentimes small but repeated hemorrhages take place from the nose, bronchi, stomach, bowels, and bladder. There is frequently retention of urine; when drawn off, the fluid is acid, and, as a rule, not albuminous, so that nephritis may be excluded as an immediate cause of death in these cases.

Hebra found that on opening any of the veins, no blood would flow, and that the vascular lumen was often filled up by thrombi.

The results of autopsies are usually negative. The immediate cause of death cannot be assigned with certainty. Among the many explanations may be mentioned:

That death is owing to congestion of the internal organs resulting from suppression of the cutaneous activity and of the perspiration.

That the patient dies just as a rabbit dies when its skin is varnished. The incorrectness of this notion has been proved, as was shown in another part of this work, by the experiments of Senator.

Sonnenburg advances the opinion that when death follows immediately upon a burn it is owing to an overheating of the blood, and consequent heart-paralysis; but that, when the fatal result is delayed for a few days, it is caused by an excessive irritation of the nervous system, which, by reflex action, produces a lowering of the vascular tension.

V. Lesser, on the other hand (*Virchow's Archiv*, Vol. LXXIX., p. 248, 1880), maintains that oligocythemia, considered as a functional disturbance, is the cause of death from these accidents.

M. Schulze and Klebs have shown that death and the destruction of the red blood-corpuscles may result from a temperature of 43° C.

V. Wertheimer, Ponfick, and V. Lesser found after death well-marked alterations in the red blood-corpuscles, an abundance of serrated forms, blanched discs, many fragments of red blood-discs and blood-pigment, in granular form as well as in a state of solution, which colored the serum a rich dark-red. This destruction of some red blood-corpuscles, and the functional inactivity of others which preserve their forms, but are, as it were, paralyzed by being forced through over-heated tissue-tracts—these, according to V. Lesser, constitute the immediate cause of death in cases of burns.

Catiano's supposition, that death is caused by hydrocyanic acid which is generated from the formic ammonia existing on the skin, has yet to be chemically confirmed.

If sopor does not come on within the first thirty-six hours, the prognosis is decidedly favorable. In this case, it is during the period of reaction and suppuration that dangerous symptoms are to be looked for, and they will arise from extension of the inflammatory

process, arterial hemorrhages, opening of joints, thromboses, and emboli of all kinds; inflammations of the bowels (duodenal ulcers), of the kidneys, the lungs, the pleura, and the meninges not infrequently supervene. Death is often caused by exhaustion, consequent upon fever and protracted suppuration. Tetanus, pyæmia, and erysipelas are the traumatic accidents most commonly encountered.

*Treatment.*—In burns of the first degree, which soon heal spontaneously, the only indication is to alleviate the severe pain. Rest, cold, wet compresses (saturnine lotions), immersion and irrigation, are best adapted to secure this end. Coating the sore with collodion is a very painful process, although, in many cases, it prevents the formation of blisters. In burns of the second degree, besides relieving pain, we have to promote the growth of new epidermis. It is best not to open the blisters; but if these are very tense and prevent the application of dressings, they should be pricked at their bases with a needle, and the fluid pressed out, taking care not to destroy the blisters themselves. If the epidermis has been detached in small circumscribed portions only, it will suffice to powder the denuded surface thickly with iodoform, in order to form a crust under which the healing may go on. When larger spaces are laid bare, they should be dressed with the strictest antiseptic precautions. After thorough disinfection with a five-per-cent solution of carbolic acid, the sores should be covered with protective silk dipped in a four-per-cent solution of borax in water, and wrapped around with several folds of borax lint. When the sloughing is still more extensive, carbolized gauze or salicylated cotton is to be applied over the borax lint in order to absorb the fluids, and the whole enveloped in Mackintosh cloth or India-rubber silk. Whenever the dressing becomes soaked, it must be renewed. Lister has recently recommended the direct application to the burn of lint dipped in a 1 : 30 solution of carbolized oil, and over this several layers of antiseptic gauze, that may be changed when saturated with the secretions, while the lint remains until healing is completed. The advantages of the antiseptic dressing consist in the speedy relief from pain which it affords, and its effect in preventing the luxuriant growth of inflammatory granulations, which so frequently give rise to extensive adhesions and strongly contracting scars. Busch spreads Lister's borax ointment over the sore, and covers it with carbolized gauze.

Where antiseptic dressings are not required, the lime liniment (aqua calcis, oleum olivarum, ana) is the best application. The sore is covered with folds of linen dipped in this mixture, and kept moistened with it without being disturbed. The dressing need not be renewed oftener than once or twice daily. When adhesions are threatened, cauterizing with nitrate of silver is the best mode of preventing them. Either the solid nitrate or a strong solution may be employed. As often as the eschar loosens, it must be detached, until at last it is found to adhere so firmly as not to admit of removal.

Burns of the third degree, when seated on the extremities, are best treated with antiseptic dressings, combined, after the eschar has fallen off, with skin-grafting according to Reverdin's method. In extensive burns of the trunk, on the other hand, the continuous water-bath is to be preferred. The sloughing of the eschar is thus hastened, the sore is kept constantly clean, the pain lessened, and the troublesome process of changing the dressing entirely dispensed with, while the mortality from the disease is not increased. Hebra witnessed no injurious results even from keeping his eczematous patients in the bath for two hundred and seventy successive days (*Wien. Allg. Med. Zeitung*, No. 43, 1861, and in his "Text-book of Skin Diseases"). When this appliance is not available, the patient simply sits or reclines in a large bath-tub, in which is placed a common mattress or bed-comforter, with one or more horse-hair cushions for the body to rest on. A large

linen cloth should be spread over the cushions, having its ends fastened to a cord which is stretched around the vessel. At first, the water in the bath is heated to 35° C.; sometimes, however, chilliness is experienced, making it necessary to raise the temperature to 40°. In cases of threatened collapse, wine and other alcoholic stimulants must be freely administered, with subcutaneous injections of camphor, ether, and musk. Auto-transfusion (performed by placing elastic bandages around the extremities) or transfusion constitutes the final resort.

## DERMATITIS CONGELATIONIS.

### CONGELATIONS.

Congelations are distinguished from burns by their very tedious course. Inflammation and its sequelæ continue to be manifested long after the cold has produced its immediate effect. The predisposition to congelations varies to a remarkable extent in different individuals. The chief predisposing condition in both sexes is anæmia. Girls will begin to complain of these troubles when laboring under chlorosis, becoming again exempt as soon as the general health is restored. A temperature of from 4 to 5° C. will suffice to bring on congelations, so that a degree of cold below the freezing point is by no means necessary. They occur more readily in a state of repose, especially during sleep, than when the subject is moving about.

In congelations, as in burns, we distinguish three degrees.

### A. DERMATITIS CONGELATIONIS ERYTHEMATOSA.

The first effect of excessive cold is a contraction of the blood-vessels and paleness of the skin; when the cold abates, the vessels are again dilated. The retardation of the blood-current causes a bluish-red discoloration, which is accompanied by a circumscribed cutaneous œdema. Such is the mode in which chilblains (perniones) make their appearance. The fingers, toes, nose, ears, and penis, that is, those parts which have the largest superficies in proportion to bulk, are most frequently attacked. The discoloration disappears under pressure, while it is deepened as the result of warmth. Chilblains burn, itch or smart, and may continue with more or less improvement or aggravation for a long period. When this is the case, the œdematous swelling becomes more tense, the nodules feel harder, and the epidermis covering the latter is thin and shining. Usually the complaint disappears in summer, to return again at the advent of the cold season. Some degree of vascular enlargement, however, often remains when the active symptoms have subsided. Blisters containing bloody serum are produced on chilblains in consequence of external injuries, as pressure or friction (scratching). These may degenerate into running sores, with denudation and ulceration of the papillary body, and may give rise to venous and glandular inflammation.

### B. DERMATITIS CONGELATIONIS BULLOSA.

When the action of cold has been of longer duration, blisters are formed, containing a clear or bloody serum, and varying in size from that of a pea to that of an apple. After these are opened, an ulceration of the underlying tissues often takes place, which reaches to the bone and is exceedingly protracted.

### C. DERMATITIS CONGELATIONIS ESCHAROTICA.

In cases of congelation, gangrene may occur underneath the blood-blisters or where no blisters have been formed. The affected part becomes pale, livid, cold, and insensible,

and when, for instance, the toes are frozen, the patient goes on walking without complaint for days together. The process of sloughing generally takes place very slowly, while the line of demarcation is being formed, and often requires to be aided artificially. Extensive congelations not unfrequently result in pyæmia or septicæmia, since the blood-vessels of the affected region continue to discharge their office, and in this way putrid substances may be admitted into the circulation.

Treatment should first of all be prophylactic. When their development is favored by anæmia, this condition should be remedied, and the patients be directed to wear woollen stockings and gloves. Recent congelations should be rubbed with snow or cold water, and not restored to warmth too rapidly. Chilblains will generally bid defiance to all remedies so long as the patient continues to expose himself to cold. When they are inflamed, the affected member should be kept in a horizontal position, and wrapped in cold lead-water cataplasms, and these measures should be continued as long as they are agreeable to the patient. In cases of swelling and the formation of ganglia, tincture of iodine (even the colorless preparation) has proved of decided benefit. Lemon-juice, dilute hydrochloric or nitric acid, creasote, pyroligneous acid, chloride of lime, caustic lime, collodion, camphor, petroleum, and turpentine have each been likewise recommended. Gentle pressure, applied by means of Martin's elastic bandage, has often produced good results. Sprinkling with iodoform or chrysarobin is often very serviceable in promoting healthy granulations on ulcerated chilblains. When symptoms of irritation predominate, Lister's borax ointment or the emplastrum fuscum is to be preferred. Blisters should be broken, and their bases thoroughly and repeatedly cauterized with nitrate of silver, until a clean suppurating surface is presented. In extensive gangrene, antiseptic dressing, together with vertical suspension of the extremities (Bergmann) or the continuous water-bath (Hebra), should be resorted to.

### *Dermatitis Traumatica.*

In this variety are displayed all the phenomena of inflammation with their sequelæ. It is produced by blows, concussions, pressure (as from trusses, tight boots), or by friction (in rowing, scratching, etc.). The treatment is in accordance with general surgical principles.

### *Dermatitis e Venenis et Causticis.*

Under this head are included a large number of inflammations, arising from the injurious action of various substances upon the skin. These substances either produce merely redness, swelling, vesicles, and bullæ, or eruptive blotches, or they entirely destroy the skin by effecting chemical changes, which frequently put an end to life itself. Such are the caustic agents (concentrated mineral acids, caustic potash, caustic lime, arsenic, etc.). The treatment of this class of inflammations is similar to that already described in connection with burns.

## ECZEMA.

### *Catarrh of the Skin.*

Eczema is by far the most frequent, and hence practically the most important of cutaneous diseases. According to our experience, it includes more than one-third of all cases of those diseases that come under treatment—an estimate which agrees with the statements of Erasmus Wilson, McCall Anderson, of Glasgow, and Bulkley, while Hebra found that, in Vienna, it constituted only sixteen per cent of all the cases. Hebra also

found that twice as many females as males were affected with the malady. According to our observation, the proportion of the sexes in this respect is about equal. No period of life is exempt, although it occurs most frequently in childhood, when the skin is peculiarly soft, delicate, and susceptible.

Eczema is remarkably protean in its manifestations, showing itself under the most varied forms.

*Definition.*—Eczema is a simple, non-contagious, catarrhal inflammation of the skin, acute or, more frequently, chronic in form, beginning as an erythematous redness, or as an eruption, either scattered or in groups of papules, vesicles, or pustules, or of all these together. It is associated with more or less redness and swelling of the skin, and with severe burning and itching, followed by the appearance of moisture and the formation of crusts, partly yellow and gummy, partly green and brown, or by a dry scaly eruption upon a red base.

Eczema is precisely analogous to catarrh of the mucous membrane. Just as catarrh of the mucous membrane consists in a more or less increased secretion from the mucous glands and an abundant desquamation of the peculiarly altered superficial epithelial layer, combined with an increased exudation from the overloaded vessels of blood-serum, containing a greater or less amount of cell-elements (serous or purulent catarrh), so, in eczema, there is a similar discharge of blood-serum and cell-elements, with a similar shedding of the horny layer, and as chronic catarrh of the mucous membrane is characterized by swelling, infiltration, and increased redness, so chronic eczema presents infiltration and hyperæmia of the skin. We may convince ourselves that the process is the same in both cases by observing it in situations where the epidermis passes into mucous membrane.

The *symptoms* presented in every case of eczema are as follows :

1. Hyperæmia—active as a rule, though frequently passive, especially in dependent portions of the body—forms the initial stage (stadium erythematosum). This may pass directly into desquamation, and I fully agree with Kaposi, who maintains, in opposition to Auspitz, that there are eczemas which do not advance beyond this stage, although this process is not entitled on that account to be called an erythema, especially when it occurs in cases of eczema, and is associated with intense itching.

Exudation.—This constitutes the eruptive stage. Small punctiform papules, vesicles, or pustules make their appearance on a reddened base ; these may dry up and pass into the third stage, or the epidermis may break, and the serous or purulent secretion be discharged upon the surface of the skin (moist eczema).

Desquamation.—This is the final stage of eczema (eczema squamosum). The typical succession of phenomena just described may be most clearly traced in acute eczemas.

Eczema is regarded as *chronic :*

1. When it recurs frequently in the same situation. This, however, strictly speaking, is only a relapsing form of the acute disease.

2. When certain insidious secondary processes have set in, such as occur in some cases of chronic catarrh of the mucous membranes. Among these complications are diseases of the absorbent apparatus, and conditions of engorgement, accompanied by atrophic alterations in the glands and adipose tissue.

Eczema is divided into the following varieties, according as one or another of the above symptoms predominates :

1. Eczema erythematosum exhibits a diffuse or punctiform redness and swelling of the skin, gradually subsiding at its circumference, sometimes confined to small spaces,

sometimes extending over the whole body. It either terminates in desquamation, or passes into other forms.

2. Eczema papulosum (Hebra) shows itself in the form of small, round or acuminated, irregularly-scattered papules, as large as a pin's head, and attended with troublesome itching. The apices of the papules being rubbed off by scratching, small, black points of dried blood appear in their places. They are either confined to circumscribed blotches, or dispersed over large areas, which sometimes include the entire bodily surface. In the latter case, the intolerable itching renders this form one of the most distressing and intractable of cutaneous maladies. Usually it begins and ends with the papular eruption, which, however, is sometimes succeeded by vesicles or pustules.

3. Eczema vesiculosum consists of an eruption of vesicles no larger than the head or point of a pin, on a surface uniformly red, or dotted with that color; these are generally very numerous, and distributed in groups, less frequently isolated. They often coalesce so as to form large blisters, in places where the epidermis is thickened, as on the palm of the hand or sole of the foot. The individual vesicles are tensely filled with a transparent, yellowish fluid; their surrounding surface is red and swollen, and the accompanying itching is intolerable. The vesicles may collapse, dry up, and disappear by desquamation, or the variety to be afterwards considered under the name of eczema madidans may be produced, partly through the destruction of the vesicles by scratching, partly through their spontaneous rupture. The usual seat of eczema vesiculosum is the face, the hands, or the fingers.

4. Eczema pustulosum s. impetiginosum differs from the preceding varieties in the fact that the fluid of its vesicles contains a larger proportion of pus-corpuscles. It is either developed from eczema vesiculosum, or its pustules are formed without any intermediate process. The pustules are usually larger than the vesicles. This form of eczema is most frequently found upon the heads of children, and in scrofulous individuals.

5. Eczema madidans s. rubrum; eczema inflammatorium, follows uniformly one of the preceding varieties, and is characterized by a moist and reddened superficies, in which the ruptured vesicles and pustules are often discernible as minute fossæ. From this there is a free discharge of serum or pus, which dries into a firmly-adherent crust of a yellow or green color, or brownish from the admixture of blood. Any part of the body may be affected, but especially the legs (salt-rheum), ears, scrotum, and bends of the joints.

6. Eczema squamosum (psoriasis diffusa et palmaris, Wilson; eczema psoriasiforme, Devergie) constitutes the final stage of typical eczema; it may arise from any of the preceding forms, but may itself persist for years. It is characterized by red spots varying in extent, and with a dry and scaly surface. The scales are of every size, from a grain of dust to large shreds of epidermis. The affection is generally associated with infiltration of the skin.

7. Eczema rhagadiforme is characterized by fissures, either superficial or penetrating the entire integument, extremely painful and often rendering all movement impossible. They occur most frequently over the joints, and are caused by the brittleness of the infiltrated skin, which gives way on movement. The finger-ends are particularly liable to this form; their skin becomes dry, brittle, and traversed by numerous easily-bleeding and exceedingly painful fissures. As heretofore explained, all these varieties are but manifestations of a single disease; they may pass into each other, and are frequently met with in different localities on one and the same individual at the same time.

### ACUTE ECZEMA.

This is ushered in by the appearance, either at a single spot or in several places, of inflammatory redness and swelling, resembling erysipelas, with a feeling of burning and tension, accompanied by general uneasiness, gastric derangement, sleeplessness, shiverings, and even rigors, the bodily temperature being above the normal, and the pulse rapid. In about forty-eight hours, numerous small papules or vesicles containing a clear or turbid fluid arise on the affected surface. The eruption extends, scattered spots, papules, or vesicles breaking out around the first crops, or the disease manifests itself *de novo* on remote regions; for the entire integument becomes excessively sensitive during an attack of eczema, and the slightest irritation will suffice to call forth the above symptoms, in previously healthy parts. In the most favorable cases, the vesicles and pustules dry up and disappear, with intense itching and the formation of crusts and scales, or else those phenomena supervene which have been already described under the title of eczema madidans. The entire process occupies from two to six weeks. The eruptions often return in the same or different localities, and thus the disease gradually becomes chronic. Moist eczema is the most common form; next in frequency are the papular and erythematous varieties (eczema intertrigo). Every portion of the skin is liable to the attacks, but they occur most frequently in the following situations:

(*a*) *Eczema acutum faciei.*

After the precursory chill, the face begins to redden and swell, the eyelids are puffy and immovable, the ears also are greatly swollen, and the lips are bloated and cannot be opened. Careful examination and palpation of the skin will disclose an unevenness, often perceptible only under oblique illumination, which is caused by the presence of numerous minute papules and vesicles. The vesicles break quite early, especially on the ears, and discharge their contents very profusely. Hearing is impaired when the eczema extends to the auditory canal. Recovery takes place in from three to six weeks, but small spots are often left unhealed, and lay the foundation for chronic facial eczema.

(*b*) *Eczema acutum genitalium virilium*

Is associated with great swelling of the penis and scrotum; the latter part is very subject to moist eczema, while the penis usually throws off the disease at once by desquamation.

(*c*) *Eczema acutum manuum et pedum.*

Either isolated vesicles appear on the fingers or toes, together with slight redness, or the whole hand or foot swells, and the instep or back of the hand becomes highly œdematous. The fingers are enlarged, painfully swollen, and covered with numerous vesicles which often pass into pustules. The corium is frequently denuded to a considerable extent, and the nails may fall off. The pustules and crusts dry up, and the skin returns to a healthy condition in the course of a few weeks.

(*d*) *Eczema acutum universale.*

This is fortunately of rare occurrence; it results from the coalescence of numerous localized eczemas. I shall not soon forget the appearance presented by a gentleman afflicted with this form of eczema; he received me in a state of complete nudity, being unable to endure the contact of even the lightest garment. His pulse was 110; temp. 39.5° C.; tongue thickly coated; face red and bloated; scalp covered with a scurfy erup-

tion; the whole body scarlet, and the skin hot to the touch. The penis and scrotum were greatly swollen, the latter exuding freely; vesicles were plainly visible in the bends of the joints, while a moist eruption occupied the axillary region. The patient was sleepless, and in a state of extreme agitation. The use of stimulants and all irritating applications were forbidden; the skin was simply covered with starch-powder; and in a few weeks the whole disorder had disappeared. As might be expected, this variety of eczema assumes many different aspects.

### (*e*) *Eczema Intertrigo.*

This occurs were two cutaneous surfaces are in contact, and proceeds from the erythema intertrigo of such localities. Children and corpulent adults are most liable to its attacks. The eruption is usually situated in the folds of the genitals, in the anal fossa, beneath pendulous mammæ, and at the bends of the joints. In rare instances, the inflammation runs so high, in consequence of neglect, that even diphtheritis and gangrene, with their sequelæ, may be developed (Caposi).

## CHRONIC ECZEMA.

Chronic eczema presents the same changes as the acute form; but, in addition, exhibits others, resulting from repeated attacks of inflammation. In chronic eczema the skin is swollen, thickened, reddened, and darkly discolored. In protracted cases, the corium often contains small thickenings of the connective tissue resembling furuncles which are hard to the touch, and merge gradually into the surrounding structure. The apices of these formations are generally scratched off, and they are most frequently met with on the extremities. The subcutaneous tissue may take part in the inflammatory process. Certain cases of chronic eczema are characterized by profuse exudation, while others, and these the most frequent, merely present a few scabs on the affected surface. Chronic eczema often gives rise to ulcers, particularly on the legs. The itching is usually extremely distressing, and compels the most resolute patient to scratch. Even if he is able to keep from doing so in the day-time, the inclination becomes irresistible at night, and especially on getting warm in bed. The lesions caused by scratching, and the intense cutaneous irritation, give rise to an increased exudation of plasma, which stiffens the linen. This exudation is accompanied by an abatement of the itching, and by a painful burning sensation, which, however, is hardly noticed by the patient in comparison with the previous symptom. The itching is much aggravated by everything which irritates the skin. Numerous boils frequently make their appearance during the course of chronic eczema; the cause of this phenomenon is not very clear. It is certainly observed more frequently when the disease is treated with ointments than when aqueous and alcoholic solutions are relied upon.

There are other varieties of eczema, dependent on its locality. These we will now proceed to consider.

### (*a*) *Eczema Chronicum Capillitii.*

This is most frequently met with in children, but is not a rare affection among adults, generally in the forms of eczema squamosum and impetiginosum. Its peculiar features are due to the hair and the numerous sebaceous glands of the scalp. It attacks either circumscribed portions only, or the entire surface. In the latter case, adjacent regions, as the forehead, neck, and ears, are also involved. In eczema squamosum the scalp is reddened and covered with a plentiful crop of white, greasy scales. In eczema madidans

the hairs are agglutinated into tufts by the abundant secretion, which is mingled with the contents of the sebaceous glands. This being decomposed by the action of the atmosphere, the fatty acids are set free, producing that abominable odor of rotten straw which belongs to neglected cases of eczema. If the crusts are allowed to remain, and the hairs are not cleansed, the latter mat together almost inextricably, and in this condition become a breeding-place for lice and insects (plica polonica); on the other hand, lice may constitute its exciting cause. When this occurs, the affected places are generally of small dimensions, surrounded by healthy integument, moist, and covered with a thick brown crust, on which papillary growths a few millimetres in height are sometimes visible. The cervical glands are always swollen, but rarely suppurate. Abcesses of the scalp, however, are often met with, especially in weakly children. Ordinarily, the hair comes out in large quantities, but is reproduced. In not a few cases, the hair-follicles are destroyed by suppuration (sycosis capillitii) and permanent baldness is the result.

### (*b*) *Eczema Chronicum Faciei.*

The face is very often the seat of chronic eczema, especially in children, in whom it assumes a moist and pustular character, and is associated with eczema of the scalp. In adults, the squamous form is more frequently observed. Sometimes the disease extends over the entire face, sometimes only isolated portions are affected. On hirsute parts of the face, the inflammation often attacks the hair-follicles and assumes the aspect of a sycosis, each pustule appearing to be pierced by a hair. The process involves the beard, eybrows, hairs of the nostrils, and especially the eyelashes; around the latter, cup-like ulcers are frequently produced. While, however, in sycosis the disease is confined to the hair-follicles, removal of the eczematous crusts leaves a moist surface, which often spreads over the vicinity of the hairy parts. The eruption is usually symmetrical. In situations where the epidermis merges into mucous membrane, the latter is generally attacked. Eczema in these localities is exceedingly intractable, especially at the nasal aperture. In scrofulous subjects, the nostrils are often completely obstructed by crusts. The patients breathe with their mouths open; the secretion collects beneath the scabs and gives rise to lymphangitis and erysipelas, which produce a snout-like prolongation and thickening of the upper lip. In adult males, chronic coryza will often cause such an eczema of the upper lip to degenerate into sycosis. Very frequently, eczema of the nose, mouth, or canthi results in very painful fissures. The disease often affects the vermilion borders of the lips in the shape of E. rhagadiforme. The lips are dry and hard, and beset with numerous fissures; they desquamate or are covered with bloody crusts. This form is especially frequent among females, and is associated with intense itching. Usually, the skin around the red portion of the lips is also attacked, so that the mouth is inclosed as by a broad ring.

Chronic eczema of the ears is distinguished by an extraordinary tendency to acute relapses, generally accompanied by profuse exudation. The sulci of the concha are obliterated, or nearly so, and the skin is greatly swollen; a very deep fissure, extending even to the aural cartilage, is frequently formed in the fold behind the ear. The disease often attacks the auditory canal, which is then greatly swollen, and its orifice filled up with crusts or scales; the hearing is also impaired. In such cases, exceedingly painful boils often break out in the external auditory canal.

Eczema of the eyelids often causes considerable swelling of these parts, with immobility; they are agglutinated, and unpleasant-looking yellow crusts collect around

the lashes. When this condition is of long duration, it leads to very obstinate ectropium. At the same time, a catarrhal conjunctivitis is almost always manifested, which sometimes develops into blennorrhœa or even diphtheritis.

### (*c*) *Eczema Chronicum Mammæ.*

This is particularly apt to affect one, or, more frequently, both of the nipples, in the case of nursing women, especially primiparæ; but it also occurs, though rarely, in virgins and males. It begins with a superficial excoriation of the nipple, and a slight discharge, which rapidly dries into a small scab. When left undisturbed, the sore soon heals spontaneously, but the constant irritation of suckling causes it to spread over the whole nipple and the areola. The nipple becomes raw, fissured, and swollen, and so spread out that it appears as a broad, red, and moist protuberance, only slightly elevated above the level of its firmly-incrusted areola. The eruption is always circularly disposed around the nipple. It is not unfrequently followed by mastitis.

According to Paget (St. Bartholomew's Hospital Reports, 1874), an eczematous affection of the nipples (Paget's Disease) often precedes mammary cancer. Later observations, however, have shown that this is a correct statement only so far as regards a very superficial epithelioma of one of the orifices of the lactiferous glands.

### (*d*) *Eczema Chronicum Umbilici.*

The umbilicus is frequently attacked by eczema, especially in corpulent individuals, and here also the eruption usually assumes a circular form. The umbilical fossa is often filled with an easily decomposed, fœtid secretion.

### (*e*) *Eczema Chronicum Genitalium et Perinæi et Ani.*

Eczema of the anus is very often the starting-point for the same disease of the sexual organs, and is frequently associated with hemorrhoidal troubles. Eczema of the anus often continues for several years before it attacks the genitals, which is does under the form of an acute eruption. It is frequently accompanied by very painful rhagades, which seriously interfere with defecation, by a profuse secretion of mucus, and by troublesome itching, especially at night. The straining at stool often results in swelling and prolapsus of the rectum. Subsequently, the eruption extends mostly along the anal fossa. The manifestations of perineal eczema are of a particularly obstinate character along the line of the raphe. Next to the anus, the most frequent starting-point for eczema of the genitals is the folds of the thigh, especially where the skin is in contact with the serotum. It is very seldom that the complaint attacks the entire surface of the penis; usually, the dorsum exhibits only a few transverse furrows of eczema, while that portion of the under surface which touches the scrotum is covered by the eruption and exudes freely. On the scrotum, moist eczema very often occurs, while the squamous form is more rarely met with. The scrotum is enlarged, has a glazed appearance, and secretes a fluid which decomposes almost immediately and smells abominably. In cases of long standing, the scrotum swells so enormously that the patient believes himself to have elephantiasis. The itching is often very intense, and comes on in paroxysms. (The so-called eczema marginatum, which so frequently appears on the thighs, especially where they touch the scrotum, is one of the mycoses.) In females, the labia majora are very often the seat of vesicular eczema, but this is quickly transformed, by scratching, into eczema madidans; it is accompanied by great swelling of the parts. The labia

minora and vaginal orifice are frequently affected in the same way. The complaint in these localities is generally associated with vaginal leucorrhœa. From the genitals the eruption often extends over the mons veneris and the surface of the thighs and abdomen.

*(f) Eczema Chronicum of the Folds of the Joints.*

Unlike psoriasis, eczema prefers the inner surface of the joints. After crusts have formed or cutaneous infiltration has taken place, very painful fissures are produced as the result of movement. The patient, therefore, maintains the affected limb in a semi-flexed position, so that one might almost believe it to be ankylosed. The disease in this situation generally occurs symmetrically.

*(g) Eczema Chronicum Cruris.*

Salt-rheum, as the moist form is popularly called, is that in which it most frequently appears on the leg, and is one of the most practically important varieties of the complaint. It is often associated with varices, and may lead to hemorrhages, ulcers of the leg, thickening of the skin, œdema, and enlargement of the limb resembling elephantiasis. Dark, discolored spots usually remain upon the skin after healing has taken place. The small, scattered pustules, each in general punctured by a hair, and the small and often very painful abscesses which belong to E. impetiginosum of the leg, constitute peculiar features in this complaint.

*(h) Eczema Chronicum Manus et Pedis.*

Eczema of the hands and fingers is very often the result of injuries of those parts. All forms of eczema are liable to occur on the hands, but more especially on the fingers. Usually, the disease makes its appearance on the inner surface of the fingers, in the form of sago-like vesicles, with elevated borders, which, when opened, discharge a gummy, tenacious fluid. Owing to the thickness of the epidermis on the palm of the hand, the vesicles in this locality often remain for a long time, and then dry up and desquamate, leaving the skin perforated with numerous small holes, as if by a punch. Old eczemas on the inner or outer surfaces of the articulations commonly result in the production of painful rhagades; and there is often very considerable infiltration of the cutis, especially on the back of the hand.

A peculiar form of eczema occurs on the palm of the hand, especially in anæmic females, as a dirty, dry, indurated, smooth thickening of the epidermis. The furrows of the hand are reddened and filled with a whitish powder resembling flour. Only the itching and the co-existence of similar eruptions on other parts enable this affection to be recognized as eczema. It may render the fingers incapable of complete extension; in my two cases, even the nails were affected, becoming dry, brittle and fissured, traversed by vertical or horizontal furrows, sensitive, and even painful. The walls of the nails were reddened and greatly swollen. Eczema of the feet gives rise to similar phenomena.

PATHOLOGICAL ANATOMY.

Acute eczema, anatomically regarded, differs in no respect from other inflammations of the epidermis, with predominant serous exudation. The papillæ in circumscribed portions of the skin are enlarged and lengthened through their infiltration with cell elements and a clear serous fluid. The connective-tissue corpuscles of the papillæ become more numerous and undergo a marked increase in size and succulence. In the stratum mucosum, as V. Biesiadecki has shown, fusiform cells abound, extending half-

way into the papillary layer, half-way into the deepest portion of the former structure. These, in their advance, force asunder the cells of the stratum mucosum, and reach even as far as the epidermis. They form around the swollen epithelial cells a network, which serves as an outlet for the escape of the exudation to the surface. The development of a vesicle hastens the new cellular formation within the papillæ, and the superficial cells of the stratum mucosum swell up, perhaps even to bursting, and lose their epidermal investment. The more intense the inflammation the more deeply it extends into the corium and even into the adipose layers. The exudation consists of serum and white blood-corpuscles. The multiplication of the latter causes the vesicle to change into a pustule. The usual reaction of the fluid is slightly alkaline.

In chronic eczema the microscope reveals considerable thickening of the epidermis and the corium, with dark discoloration. The papillæ are often so greatly enlarged, especially in moist chronic eczema of the leg, that they are visible to the naked eye as red points upon the oozing surface (Bulkley).

There is also enlargement of the lymphatics and blood-vessels; thick deposit of cells and coloring-matter; increase of connective tissue at the expense, partly, of the obliterated sebaceous glands and hair-follicles and of the degenerated sudoriparous glands; atrophy of the fat cells, and degeneration of the nerve-fibres.

### ETIOLOGY.

Is eczema a local or a constitutional disorder, and ought the inflammatory symptoms resembling those of eczema which are caused by external irritants to be set apart from the latter? In my opinion, we are not justified, so long as the primary causes of the constitutional disease still remain undiscovered, in separating into distinct classes, affections anatomically homogeneous, and displaying the same succession of phenomena. The predisposition to eczema differs to a remarkable extent in different individuals. As with some persons every trifling irritation of the stomach gives rise to gastric catarrh, so in others a mere chafing of the skin will cause an outbreak of eczema.

It is certain that debilitating influences will increase the predisposition to the complaint, as they increase it in the case of catarrhs in general. Among these predisposing conditions are: chlorosis, rhachitis, scrofulosis, gout, albuminuria, diabetes, dyspepsia, gastric and intestinal catarrhs, dysmenorrhœa, uterine affections, lactation, and pregnancy. Like Bulkley, and unlike Hebra, I had never seen an instance of the last-named state predisposing to eczema until, while actually engaged in writing these lines, a woman came under my treatment in her eighth pregnancy, who, since her third, had been attacked with eczema regularly each time in the third month, and disappearing spontaneously at the end of her confinement. Eczema is often observed to be aggravated during the menstrual period. Psychical influences may also be the immediate cause of the complaint, where a predisposition exists. Persons having a very delicate skin are more liable to the complaint. Susceptibility in this direction is also increased by repeated attacks. Varicose veins and hemorrhoids tend directly to the production of eczema in congested localities, as the anus or the legs.

On the subject of heredity in this disease, I, like my father, am at variance with the majority of authors, both of us having met with frequent instances of its occurrence by descent. This may probably be accounted for by supposing that in private practice only the most inveterate cases come under notice, in which category hereditary eczema must undoubtedly be placed. But one instance of this kind need here be cited. A girl of sixteen was placed under our care for eczema by her father, a medical man. He himself

and his mother, as also his second daughter, were sufferers from the complaint. Similar examples might be multiplied. Eczema is observed with special frequency in scrofulous and phthisical families.

Foremost among the external causes is the action of water. Eczema is often brought out by the wet-sheet packing and baths of water and vapor administered at hydropathic institutions. Sulphur and saline baths still more frequently produce the same effects. The eczemas due to these causes are most nearly related to those arising from injuries to the skin, as eczema intertrigo, eczema from india-rubber clothing or bandages. The "chafing" of children may result not only from perspiration, but also from the alkaline character of their discharges. Another predisposing affection is the sudamina (miliaria alba et rubra, hydroa) which so frequently occur, under the form of papules and watery blisters, in patients who sweat profusely.

Numerous drugs may give rise to eczema: croton oil, tartar emetic, cantharides, mezereum, mustard, hellebore, potash-alkalies, mercurial sublimate, sulphur, blue ointment, belladonna ointment, arnica tincture, and turpentine (especially as a component of adhesive plaster, diachylon plaster, etc.). Since the introduction of the antiseptic method in surgery, carbolic acid eczema has been frequently observed; it is generally characterized by numerous vesicles and copious exudation. With these may be classed those chemical substances which affect the skin through their action on the spinal system of nerves: the mineral acids, arsenic, vegetable juices, anilin dyes, resins, turpentine (in house painters and printers), soap and water (butlers and barbers), alkalies (washerwomen); pulverized materials, as flour, cement, plaster, powerdered spices (millers, bakers, masons, agricultural laborers, grocers).

Among the dynamic influences tending to the production of eczema may be mentioned heat and cold (E. solare, E. caloricum). In winter, the disorder very commonly takes the form of chapped hands.

The disease may also result mechanically from pressure and friction, especially of the clothing, but principally from scratching, which is operative in all complaints accompanied by itching.

The cause of eczema when following vaccination must be sought in cutaneous irritation, and not in any specific action of the virus employed.

Eczema and psoriasis are often observed to occur simultaneously. This is also true of asthma and eczema—a fact not to be wondered at if eczema is recognized in its true character as a catarrh of the skin.

### DIAGNOSIS.

If the symptomatology be kept in view, all the affected localities being at the same time carefully compared with each other, its diagnosis in most cases will present no difficulty. Still, it may possibly be confounded with the following complaints:

1. Erysipelas is frequently mistaken for acute eczema. The latter, however, exhibits little redness or swelling, and its fever is of a lower grade. The diminutive papules or vesicles of eczema are perceptible under oblique illumination, or by palpation. Eczema of the face usually breaks out in several places at once, whereas erysipelas in the same situation spreads from a single point. In erysipelas there is usually a discharge of fluid, but this proceeds from the rupture of large bullæ.

2. Epithelioma in the first stage. The small extent of the epithelioma, its sharply-defined borders, and the absence of itching, are sufficient to prevent mistake.

3. Lichen. While the papules of eczema change into vesicles or pustules, or dis-

appear altogether, those of lichen remain firm, solid, unaltered, and tipped with scales, for a considerable period.

4. Pruritus of the genitals is particularly apt to be mistaken for eczema. But the papules, vesicles, and moist surfaces are wanting in pruritus. Its only visible signs are the results of scratching.

5. Herpes is attended with a burning sensation; eczema with itching. The vesicles of herpes are in isolated groups; those of eczema are densely aggregated, without regular arrangement.

6. Miliaria crystallina. The vesicles of eczema are crowded together in confined spaces; those of miliaria are isolated, especially on the breast and abdomen. Eczema is accompanied by pruritus; miliaria by stinging pain and uniformly by fever.

7. Pemphigus vulgaris. The large bullæ characteristic of pemphigus are not seen in eczema. Pemphigus foliaceus is distinguished from eczema by the extensive exfoliation and superficial soreness, with scanty exudation, to which it gives rise, and by the absence of itching and cutaneous infiltration.

8. Scabies. This is localized chiefly on the hands and fingers, in the axillæ, and on the breast, abdomen, and penis. It does not attack the hairy scalp. The itch-vesicles are less closely aggregated than those of eczema. The principal mark of distinction, however, is the acarus-burrows.

9. Favus can be confounded only with the pustular varity of eczema. Favus exhibits sulphur-colored crusts which are dry and friable. The crusts of eczema have a yellow or dark appearance, and a gummy consistence. Underneath them is a moist surface. Favus always results in baldness, and the hairs of the affected parts are bleached, lustreless, and brittle.

10. Sycosis. The crusts of eczema are larger than those of this disease. The skin beneath them is smooth in eczema; in sycosis it is rough and glandulous. The hairs can be drawn from the pustules of sycosis without giving much pain; in eczema this is not the case. By the latter disease, moreover, the beard is generally left untouched.

11. Syphilis. Syphilitic pustules on the head may be mistaken for E. impetiginosum. The pustules are scattered over the scalp, and removal of the crusts discloses an ulceration with perpendicular borders. The pustules are succeeded by scars, and there is no itching.

When eczema is seated on the palm of the hand, it is often impossible to distinguish it from syphilis, on a first inspection. In syphilis the infiltration is more solid and extends deeper into the tissues; the discoloration does not disappear under pressure. Close examination shows the blotches to be composed of numerous points, papules, and tubercles, mostly arranged in circles. They have a strong tendency to become enlarged peripherally. Their outline is usually irregular and undulating, in most cases there is no itching. When syphilis affects the labial commissures, it produces fissures exactly resembling those of eczema, but the other features of the latter disease are wanting. Besides the fissures, syphilis generally gives rise to flat papules.

12. Seborrhœa.—Eczema is often found in the neighborhood of the hairs. It is also attended with itching and glandular enlargement. A red and inflamed, and frequently a moist surface is left after the removal of the scales, while in seborrhœa the cuticle remains intact and of its natural color. Seborrhœa spreads uniformly over the entire scalp; eczema often attacks only isolated spots.

13. Lupus Erythematosus. The scales adhere very firmly, and extend into the

enlarged sebaceous glands. The scales of eczema are easily detached. Lupus erythematosus leaves contracting cicatrices, and is unaccompanied by itching.

14. Pityriasis Rubra. In eczema, the eruption is usually moist, with well-marked infiltration and thickening of the skin. Pityriasis rubra exhibits a uniform redness, with an abundance of thin scales, like shreds of paper, and is generally attended with severe burning pain. Pityriasis is never moist. It is characterized by a profusion of thick, silvery-shining scales, which, when detached, leave a red surface dotted with blood-points. The patches of psoriasis are sharply defined, and are chiefly met with on the anterior surface of the limbs. The two diseases are almost certain to be confounded, except after lengthened observation, especially E. squamosum and psoriasis universalis, in which, besides the history of the case, only the appearance of a moist eruption renders differentiation possible. When eczema occurs on the hand, its diagnosis is very difficult; in this situation, Hebra and Caposi recommend frictions with caustic potash, in order to bring out the vesicles more clearly. In eczema, there are usually small vesicles between and on the end of the fingers. Eczema itches violently; psoriasis not at all, or only moderately. Psoriasis heals from the centre of the eruption; eczema from its circumference.

16. Herpes tonsurans can be confounded only with eczema squamosum. The acute character of herpes tonsurans, its blotches, sharply-defined and healing from the centre, its contagious nature, the slight itching which accompanies it, and, above all, its microscopic fungi, leave no doubt as to its diagnosis. The scalp in herpes tonsurans is lead-colored, dirty, and grayish-looking; the hairs are dry and broken. Herpes marginatum, the parasitic origin of which has been demonstrated by Köbner, Pick, and Caposi, is identified by the sharp borders of its eruption, which heals from the centre, and its fungi.

### PROGNOSIS.

This is always very favorable, so far as life is concerned. The prognosis varies according to the cause of the complaint. If this is external and avoidable, or if it is some curable constitutional disorder, like anæmia, etc., the outlook is more favorable than when such conditions as uterine diseases, varicose veins, etc., are to blame. Hereditary eczema is always difficult of cure.

The prognosis is also influenced by the locality of the complaint. Eczema relapses more frequently on the hand than in any other situation, and it is very hard to cure in those places where the epidermis merges into mucous membrane. It is also more tedious when seated on hairy parts. It is always well to be careful about predicting its period of duration, but, in the great majority of cases, it can be permanently cured

### TREATMENT.

Every case of eczema can be cured without injury to the general health, nor have we ever observed the slightest ill result from removing the malady.

#### 1. INTERNAL REMEDIES.

As in treating any case of catarrh of the mucous membrane, all co-existing constitutional disorders and organic affections must be taken into consideration, so also must eczema be managed. When, however, no such complications exist, local measures alone will be sufficient.

In acute eczema, internal treatment, apart from cooling draughts and an occasional mild purgative, is inapplicable.

In chronic eczema, demulcent drinks and decoctions, mercury, and iodine are useless, and even injurious. The same may be said of ergotine. A specific for eczema has yet to be discovered. Arsenic may be worth trying in many chronic cases with extensive infiltration. Little, however, is to be expected from its use without accompanying external treatment. When there is chlorosis, iron must be administered. We prefer pilul. ferri carb. 6.–9. daily. In long-standing cases, the following compound of steel and arsenic has done good service:

℞ Liq. kal. arsenic. . . . . 5.0
Tinct. ferri pom.,
Tinct. rhei. vin . . . . . ana 20.0
Aq. menth. . . . . 140.0
S. One-half tablespoonful every day.

The natural and artificial chalybeate waters and the ferruginous pyrophosphate springs may also be employed. For scrofulous subjects, cod-liver oil is indicated; where bronchitis exists, phosphate of lime; gout requires alkaline waters (Vichy), etc. When dyspepsia, constipation, or hemorrhoidal troubles are encountered, the usual remedies may be resorted to. As to dyspepsia, I believe that it is very frequently not the cause, but the result of an extensive eczema. A well-regulated and invigorating diet, from which injurious fats and acids are excluded, fresh air and moderate exercise, are the main requisites for a cure. As symptom-remedies, chloral hydrate and bromide of potassium may be employed against the itching, which is often only aggravated by morphine and opium. My experience in the use of tincture of gelsemium, as recommended by Bulkley, has been insufficient to enable me to pronounce upon it; carbolic acid internally has produced no results in our practice.

### 2. LOCAL REMEDIES.

In the local treatment of eczema, which is by far the more effective, the physician must first of all satisfy himself as to the following questions:

1. Is the disease acute or chronic?
2. What stage is it in?

When they have been answered, it will usually be perceived that quite different modes of treatment are called for in the respective situations, since we must now be contented with merely combating the symptoms.

#### (*a*) *Acute Eczema.*

In the management of this form, the principal rule to be observed is, that all irritating applications must be carefully avoided until the disease has entered the chronic stage, and even then their effects should first be carefully tested upon a small portion of the affected surface. The same means which have previously proved beneficial will sometimes entirely fail us in precisely similar cases. Rayer says that the best way of treating acute eczema is to let it alone—a dictum which is just as unassailable at the present day as when it was first uttered. During the progress of a typical case, our duty is to alleviate the distressing symptoms, and to remove all causes of injury to the skin, that is, to protect it against the pressure and friction of the clothing and the effects of heat. With this view, the patient laboring under universal eczema must lie in bed naked or wearing only a light garment. Water is often injurious, hence baths and

ablutions must be forbidden. When, however, as in the case of children, they are indispensable, distilled or boiled water, or a decoction of bran or some other demulcent substance may be used. The temperature of the liquid should be regulated according to the feelings of the patient. Soap must never be employed.

Among the numerous applications which have been recommended for the relief of the burning and itching, I will mention only the most useful.

In eczema intertrigo, decomposition of the sweat must be prevented by placing cotton batting between the apposed cutaneous surfaces, and renewing it when saturated. It is well to prepare this material by dipping it in a powder containing one per cent of boracic acid, finely pulverized, and one per cent of salicylic acid, five per cent of oxide of zinc, or five per cent of subnitrate of bismuth. Lister's borax-ointment spread upon muslin and laid between the cutaneous folds is also of service.

Powdering the diseased surface is likewise beneficial at the commencement of E. papulosum and vesiculosum. I usually make use for this purpose of pure starch flour. The powder sold by hair-dressers is not to be recommended, as it frequently contains deleterious ingredients. For amylum, we may substitute talcum venetum, semen lycopodii, or amylum oryzæ, and to impart a fragrance to the powder pulvis iridis may be added. Caposi gives the following formula: ℞ Amyl. oryzæ, 100.0; Talc. venet., Flor. zinc., Pulv. irid. florent., ana 5.0. S. Make into a powder. Camphor usually forms another ingredient when the itching is violent. If no relief follows, and if, in cases of E. papulosum, the itching is unbearable, we may try bathing the parts with alcohol (cologne-water). Weak solutions of acetic acid (2 : 100 aqua), or of acetate of alumina (0.5–2 : 100 aqua) are often very effectual. Caposi recommends: ℞ Acid. carbol., 1.0; Spir. vin. gall., 150; Spir. lavand., Spir. colon., ana 25; Glycerin, 2.50. Even this trifling amount of glycerin frequently proves highly irritating.

The above powders are also recommended to be applied on moist surfaces. When crusts form, and the secreted fluid accumulates beneath them, they are made to burst by the pressure of the powdered cotton. In cases of violent inflammation, with severe pain, when powdering is ineffectual, cold fomentations with water or saturnine solutions may be tried, to which tincture of opium may sometimes be added. The compresses should cover no more than the diseased surfaces, and should be frequently changed, or else be kept cold by an ice-bag. Fatty applications occasionally give better results, but it must always be borne in mind that they will produce eczema in individuals whose skins are naturally intolerant of such substances. Hebra's diachylon ointment is preferable, especially when the exudation is profuse. To prevent rancidity, it is best prepared with vaseline. ℞ Empl. diachyl. simp., 20; Vaselin, 80; liquid. misce. This ointment is thickly spread on pieces of lint from four to five cm. wide, which are bound down with gauze; the face is covered by a complete mask of the former material, having openings for the mouth, eyes, and nose, and eyes, with simple slits to admit the ears, and it is pinned together behind. When the exudation has somewhat diminished, dusting the surface with lead ointment (Unna, *Berl. Klin. Wochenschrift*, 1881, p. 389) is much recommended on account of its ease of application. The mull is drawn through the melted ointment, and is then dried.

℞ Empl. plumb. simpl., 10.0; Sebi benzoinati, 10.0; Adip. benzoinat., 2.0. (To make sebum benzoinatum: ℞ Seb. taurin., 10.0; Benzoes subtil. pulv., 1.0. Digere in balneo vapor. per horas duas et cola. Adeps benzoin.: ℞ Adip. suill., 10.0; Benzoes subt. pulv., 1.0; digere in balneo vapor. et cola.)

This mull adapts itself very nicely to uneven surfaces, and is, therefore, particularly useful when employed as a mask for the face and on the genitals.

The mull is fastened behind the head with safety-pins; in cases of moist eczema, it must be renewed several times daily, the affected places being each time wiped off with cotton. On hairy parts, I use, in the acute stage, merely a watery solution of borax (1 : 100), or of acetate of alumina (1 : 100), or of thymol (1 : 1,000), either of which is applied thrice daily with a rag or small sponge. Later in the course of the complaint I resort to the preparations hereafter to be mentioned in connection with chronic eczema. In some cases of moist eczema, the lead ointment has an irritating effect, while the zinc salve, a decidedly milder compound, is borne without inconvenience.

(℞ Sebi benzoinat., 70 (in winter, 75); Adip. benzoinat., 15 (in winter, 10); Zinc. oxydat. alb., 10.0; Ol. amygd. dulc., 5.0.)

When desquamation occurs, mild ointments are indicated, to be rubbed in three times daily, such as vaseline, ungt. lenieus, ungt. rosat., ungt. zinc. (zinc. oxydat., 1 : ungt. lenient., 20), ungt. plumb., ungt. bismuth. 1 : 50, and especially the ungt. Wilsoni (℞ Benzoes pulv., 5; Adip. suill., 160.0: digere, cola et adde Zinc. oxydat., 25.0, M. F. ungt.). Tannin ointment (acid. tannic., 1 : ungt. lenient., 10) is also very useful.

Inflamed surfaces may be covered with these ointments or dusted with a powder. If the desquamation does not cease under this treatment, we may have recourse to tar.

### (*b*) *Chronic Eczema.*

The great secret of the therapeutics of chronic eczema is persistence. Whenever possible, the treatment should be so managed as not to keep the patient from his occupation. In the majority of instances, however, this is impracticable.

The problem to be solved is threefold:

1. To remove the crusts, scales, and indurations from the affected integument.
2. To effect a healing, if possible, of the moist surfaces.
3. To put an end to the remaining infiltration, hyperæmia, and desquamation.

The removal of the crusts is accomplished: First, by the action of water, applied through compresses, douches, vapor-baths, or ordinary immersion. The compresses, which are best made of strips of gauze or fine linen, must be changed frequently, otherwise they become very hot, and themselves give rise to eczema. Hard water ought not to be used—distilled water is best—or, if this is not obtainable, rain-water, river-water, or water which has been boiled. Equal parts of Goulard's lotion may be added to it if the skin is irritable. Ice water is to be avoided, since common salt is often added to the ice to make it last longer (Hebra). Wet bandages covered with india-rubber cloth, so as to need changing less often (Priesnitz), are recommended only in eczema of the scalp, hands, legs, and feet.

Douches are applicable only to eczema of the head, and even in this they are unnecessary.

Vapor-baths speedily soften the affected parts, but are often very irritating in their effects. Baths taken in the usual way play an important part in treatment, promoting, as they do, the healing process, by dissolving the crusts and softening the epidermis. There are many patients, however, who cannot endure bathing, as it causes very decided aggravation of the eczematous symptoms, especially the itching. Non-medicinal baths are best suited to the majority of cases. If the water is hard, holding saline substances in solution, it must be boiled, and it will be well to add to it some mucilaginous substance,

as bran (four pounds to a bath) or starch-flour. Baths medicated with corrosive sublimate, alum, common salt, or sulphuret of potash, and the natural "sool" and sulphur-springs, do more harm than good. Sulphur waters are indicated only for inveterate forms of the malady, combined with a non-irritable, torpid condition of the skin. The vulcanized rubber bandages, and the gloves and socks of the same material, have an effect very similar to that of water. Like benefit is not afforded by all rubber garments, as they are apt to cause great irritation.

Oils in general, cod-liver oil, and fats are better adapted than water to the loosening of the crusts. The first are especially suitable to hairy parts, on which they are freely poured and then rubbed in with a painter's stiff brush, and which are finally covered with a woollen rag dipped in the same. The fats (for smooth surfaces) are applied after being thickly spread on flannel or lint. They consist of pork-fat, mutton-suet, and the mild ointments mentioned under acute eczema. Usually the crusts and scales come off when the dressings are removed. When this does not occur, as on hairy parts, and where the epidermal desquamation is more abundant, we may have recourse to soap, especially soft soap, or, for sensitive skins, Sarg's liquid glycerin soap, which dissolves the epidermis by its free alkali. The soft soap is rubbed on with the hand or a piece of flannel, until it forms a lather, which is washed off with warm water. Spiritus saponato-kalinus (Hebræ) (℞ Saponis virid., 200.0; Spirit. rectificatiss., 100.0; digere filtra) is very useful, especially on hirsute parts, as its fluidity enables it to penetrate further between the hairs. It is poured on a moistened piece of flannel and rubbed in. Scales and crusts are soaked in this way for several days together, fatty substances and soap being always used in alternation; but not upon the hard callosities which often give much trouble in eczema of the palms and soles, since the usual remedies cannot act upon the diseased parts. All the chemical agents previously recommended, as acetic acid, hydrochloric acid, soft soap, caustic potash, as well as mechanical measures, friction with sand or pumice stone, scraping with the sharp spoon, etc., have been superseded by salicylic acid (Unna) which speedily removes the callosities. When the latter are situated on the hand, Dr. Unna's salicylated gutta-percha plaster mull (10–20 gram per 1–5 qm.) forms the best application. After it has remained from four to eight days, the hardened epidermis can be removed along with it. A ten-per-cent salicylic ointment is then substituted, either applied by means of bandages, or rubbed in at hourly intervals.

If the diseased surface has been denuded, the second indication we have given—that of healing the moist surface—has to be fulfilled in order that it may be fitted for the application of tar. In most cases, this is best accomplished by the use of diachylon ointment or lead ointment mull. If these are too irritating, the less energetic zinc-salve mull, or zinc ointment, may be tried. Lister's borax ointment will be found serviceable in some cases. Should these be insufficient, they may be reinforced by washing with soft soap, after the manner already described. Immediately after washing off the soap, the coating of diachylon ointment must be renewed. When the diachylon ointment cannot be employed, as frequently on the face, inunctions of tannin (acid. tannic. 1 : ungt. lenient. 10) will prove speedily effectual. Where fatty substances are not tolerated, the affected surfaces may be dried by bathing them with Goulard's lotion, or with acetate of alumina (1 : 200 aqua). In these ways moist eczema may generally be changed into the squamous form, when the third requirement will remain to be satisfied, by removing the hyperæmia and desquamation. The latter often disappears spontaneously, or by the use of mild remedies, like Wilson's zinc ointment. This, however, is not generally the case. Stimulating applications must then be resorted to, foremost among which is tar—an

agent quite indispensable in the treatment of eczema. Tar, however, cannot be classed as a purely external remedy, as its volatile elements readily pass into the circulation, and are discoverable in the urine. It is obtained for medicinal use from various sources, as follows :

1. Pix liquida s. oleum empyreumaticum coniferum ; pine-tar. This, produced in Finland, is most frequently employed by us.
2. Oleum fagi, beech-tar.
3. Oleum rusci, birch-tar.
4. Oleum cadinum, from Juniperus oxycedrus.

Oleum cadinum is thinner and clearer than the other kinds, and hence preferable for use on uncovered parts, but has a very strong odor. Tar ought never to be employed in the treatment of acute, of moist, or of impetiginous eczema. In some few individuals its administration is always followed by dark urine, fever, rigors, headache, vomiting, and diarrhea. Oftentimes, this idiosyncrasy is only manifested at the beginning of the treatment, which may afterwards be continued without inconvenience. Another troublesome consequence is an exceedingly painful and obstinate eruption of acne. Tar is applied either pure or diluted with alcohol (pic. liq. 1 : spir. 1). In order to assist it in penetrating, for instance, to the scalp, it is also combined with ether (℞ Ol. rusc., Spirit. æther., ana ; Hebra). Another very agreeable and more gentle mode of employing it is in the form of an ointment. Tar mixes best with fatty substances after having been boiled with equal parts of common alkaline soap (soap-boilers' soap) ; so long as the resulting compound continues soft, it corresponds to Ungt. pic. liq. This unites in any desirable proportion with fat, diachylon ointment, or zinc ointment, 1 : 1–20. The tar ointment is rubbed in with the hand ; the tar and spirits of tar are laid on in thin layers with a stiff brush. In order to prevent apposed cutaneous surfaces from adhering, they are powdered with starch flour after applying the spirits of tar. Tar often produces such an irritating effect, even on surfaces which have healed, as to bring back their former condition of redness and exudation. In these cases, the application is to be combined with that of diachylon ointment, the former being either mixed with the latter and spread on in the form of ointment, or diachylon ointment or lead ointment mull being applied after painting with spirits of tar. Tar ointments are contra-indicated, and spirits of tar indicated, in eczema of the beard, of the hair of the pubes, and on the hands. In the first-named situation, the former often give rise to sycosis or eczema impetiginosum, while they are well tolerated on the scalp. Tar ointments are indicated where the skin is brittle and disposed to chap. In mild cases of eczema, such as are met with in children, the tar-soap now coming into use often has a very good effect. The employment of tar must frequently be persevered in for weeks before the desquamation and redness disappear. A very favorable accessory result of its action is a lessening of the troublesome itching.

More energetic remedies are required for those isolated, circumscribed hard places which tar cannot soften. The latter may be combined with soap (Ungt. pic. liq., Sap. virid., ana), or with carbolic acid (Spir. pic. liq., 50; Acid carb., 1). Excellent results are also obtained by rubbing with soft soap twice daily, washing it off every day in a bath. Still more effectual against these obstinate indurations are naphthol ointment, pyrogallic acid ointment, and especially the chrysarobin ointment (1 : 10 to 1 : 50 vas.). It is well to begin with a two-per-cent chrysarobin ointment, carrying its strength up gradually to ten per cent. The application is made with a paint-brush. As soon as the skin becomes reddened or inflamed, the chrysarobin ointment must be discontinued, and after the lapse of a few days it will generally be well borne. The rapid disappearance of the infil-

tration from the use of chrysarobin ointment is often quite marvellous. The patient should always be warned against getting any of the chrysarobin into his eyes while bathing, since this substance produces a very severe and painful conjunctivitis.

Rhagades are healed most speedily by soft soap, which is painted into them twice a day. In cases where tar cannot be employed, tannin ointment, 1 : 10, or friction with carbolized oil, 1 : 30, or white precipitate ointment, 1 : 10, or yellow precipitate ointment, 1 : 10, will often promote healing; though I avoid as far as possible the use of mercurial preparations. Caposi recommends a 1, 2 or ½-per-cent solution of naphthol in alcohol and water. This agent is very serviceable in individual cases, especially of E. squamosum capitis. When large cutaneous surfaces are under treatment, it must, however, be used with caution, the urine at the same time being carefully watched. As soon as this becomes black, the naphthol must be stopped. The violent itching is greatly relieved by bathing the parts with vinegar, or by ointments of chloral and camphor (1 : 8 of fat) or of carbo-glycerin (Bulkley), ℞ Ac. carbol., 1; Ungt. glycer., 50, which the patient rubs on while in the bath. Against the eczema to which antiseptic surgical dressings sometimes give rise, frictions with salicylic emulsion (℞ Ac. salic. cryst., 10; Aqua destillata, 50) have been highly recommended (Nussbaum).

The therapeutics of eczema in general having now been considered, we proceed to a few remarks on the treatment of its localized manifestations.

### 1. ECZEMA OF THE SCALP.

When pediculi constitute the original cause of eczema or are generated in its course, about 50 grm. of petroleum are first to be rubbed into the scalp, which is then kept covered with a woollen cloth for twenty-four hours. After this the crusts are removed by means of ointment and spirits of soap, as already described. If moist surfaces now remain, they are treated with zinc or diachylon ointment (prepared with olive oil, not with vaseline) which is washed off with spirits of soap. Vaseline ointments are not to be used upon the head, as they do not saponify, and it is very difficult to remove them from the hair.

As soon as the exudation has ceased, tar is to be applied in the form of tinctura rusci as above, or of tar-pomade (Ungt. pic. liq., 1; Ungt. popul., 5). Should these be ineffectual, pyrogallic acid pomade, 1 : 10, is indicated. When the redness disappears, some degree of desquamation frequently continues, which is completely removed by washing the scalp daily with a 5-per-cent alcoholic solution of chloral hydrate. Female patients should not have their hair cut, but should be informed that a good many diseased hairs will fall out during the progress of the cure.

### 2. ECZEMA FACIEI.

The crusts are dissolved by wearing a mask lined with diachylon ointment, or with lead ointment mull. Moist surfaces are healed in the same way. The masks must be very accurately applied. Afterwards, we have recourse to tar, or to one of its substitutes already referred to. The disease is very difficult of cure in situations where the epidermis merges into mucous membrane.

#### (*a*) *Eczema of the Eyelids.*

Here lead ointment mull, applied at night to both eyes at once, and to alternate eyes in the daytime, has an excellent effect, especially if the ocular catarrh is removed by

instilling a ¼-per-cent solution of salicylate of lead. Sycosis of the lashes is treated by epilation, after which the edges of the lids are painted with an ointment of yellow precipitate (1 : 50 vaseline).

### (β) *Eczema of the Nostrils and upper Lip.*

First of all, the nasal catarrh which is sometimes present must be cured by injections, every two days, with a Richardson's insufflator, of a one-per-cent solution of nitrate of silver. The crusts are dissolved by tampons of cotton, dipped in zinc-glycerin (zinc. sulph., 1 ; glycer., 100), and introduced into the nostrils. Unna recommends for the same purpose, the use of drainage-canulas, wrapped around with lead ointment mull. As soon as the crusts are softened, they are painted every second day with the yellow precipitate ointment. The sycosis-like eczema of the upper lip is treated, until the pustules cease to appear, by painting them daily with an alcoholic solution of pyrogallic acid (1 : 100), followed by the application of sulphur-paste (℞ Lact. sulph., Spirit., Aqua destillata, ana 20), twice a day, with a small sponge.

### (γ) *Eczema of the Lips.*

When chaps and fissures exist in this situation, the lips are first covered with zinc salve mull ; the use of lead ointment is not advisable on account of its poisonous qualities. Very obstinate fissures are painted twice a day with soft soap. As soon as the fissures are healed, diluted tar (1 : 5 to 10 spirit), or, if this should irritate, simply first-proof alcohol, is applied in the same way to the red portion of the lips. Frequent inunction with lip-salve (ceratum cetacei rubrum) will suffice for the cure of labial eczema when caused by cold.

### 3. ECZEMA OF THE EXTERNAL AUDITORY CANAL.

The affected membrane, so long as it continues moist, is to be painted over with tannin ointment (1 : 10 vaseline), and afterwards with the diluted alcoholic solution of tar (1 : 10).

### 4. ECZEMA MAMMÆ.

Borax ointment, prepared by Lister's method (℞ Acid. boric. subtil. pulver., 1; Ceræ albæ, 1; Paraffin., 2; Ol. amygd., 2), is an excellent remedy for fissured nipples of nursing women. The nipple is washed off, after nursing, with borax water (1 : 25) and then covered with borax ointment spread on gauze. When nursing has ceased, painting the parts with an alcoholic solution of tar, together with the use of borax ointment, will generally prove effectual. If not, more stimulating applications should be employed, as poultices of soft soap, or painting with chrysarobin (1 : 10 vaseline) (Hebra recommends frictions with a solution of caustic potash [kali caust. 1 : aqua 2]).

### 5. ECZEMA OF THE GENITALS AND ANUS.

So long as the eruption is very moist and much inflamed, it is best treated with diachylon ointment, or a dressing of lead-ointment mull, held in place, in men, by a suspensory bandage, and in women by a T-bandage. As soon as the exudation has ceased, the *cautious* use of chrysarobin ointment is preferable to that of tar, on account of its speedier operation where pronounced infiltration exists. The ointment may be gradually increased in strength (1 : 10). If this treatment gives rise to much heat or redness, the ointment must be discontinued for a few days, during which the affected

parts should be powdered with starch flour. When the inflammatory symptoms have subsided, the ointment is again resorted to, until the thickening of the skin has disappeared. The last vestiges of the complaint are completely removed by spirits of tar. In eczema of the anus, the improvement from chrysarobin is often extremely rapid.

If the chrysarobin ointment is not well borne, we may employ, after the exuding surfaces have healed, an ointment of tar diachylon (1 : 20), which may be gradually increased in strength to 1 : 2. When this has taken effect (since this variety of eczema often proceeds from the decomposition of sweat), the folds of the skin should be powdered, for a still longer time, with salicylic acid (℞ Acid. salic., 1.0 ; Amyl., 89.0 ; Talc., 10.0). This must always be retained by means of a suspensory bandage. Against the intolerable itching, Bulkley recommends the application, three times in succession, for a minute at a time, on going to bed, of compresses dipped in water as hot as can be borne. This procedure is very serviceable in the case of females, but only when followed by the use of diachylon ointment, or some other mild ointment.

### 6. ECZEMA OF THE HANDS AND FEET.

Vesicular eczema of the toes, fingers, instep, and back of the hand is, as a rule, speedily cured by the use of spirits of tar and lead ointment ; unfortunately, however, it is very likely to relapse. Dry eczema, with the formation of rhagades, is also soon relieved by the same treatment. It is in this form of the complaint that Unna's lead-ointment mull is of the greatest service, owing to the ease with which it can be applied. India-rubber gloves, also, worn constantly and cleansed every night and morning, soon bring about considerable improvement in dry eczema. Yet I have never known a case of constitutional eczema to be completely cured by either of these means alone ; the application of tar or some other stimulating agent is always necessary.

Indurations on the palm of the hand or sole of the foot are removed by salicylic acid, together with inunctions of pyrogallic-acid ointment or chrysarobin ointment (each 1 : 10) ; these are more speedily effectual than tar. Superficial eczema of the palm is frequently removable by means of Carlsbad Sprudel-soap, the latter rubbed upon the hand at bed-time, and left on all night.

When eczema attacks the nails, they should be scraped as thin as possible with a piece of glass, and spirits of tar applied beneath them and within the ungual furrow. Proliferations in the latter locality must be destroyed with nitrate of silver. Poulticing the nails with soft soap often has a very good effect. This is done by cutting off the fingers of an india-rubber glove, filling them half full of soap, and drawing them over the affected members.

### 7. ECZEMA OF THE LEG.

To Dr. H. A. Martin, of Boston, belongs the great merit of having introduced the use of the elastic rubber bandage in the treatment of eczema of the leg, and of the ulcers with which it is so frequently associated. Even in long-standing cases, the patient is not detained from his occupation for a single day.

The remarkably strong, yet soft bandages devised by Dr. Martin himself are preferable to any others for this purpose. With them—in the morning before he has risen—the patient's foot is enveloped, beginning at the toes. The binder is taken off in the evening, disinfected with carbolized water (two per cent), or with thymol water (one per cent), and dried during the night. The exuding surface is covered in the evening with lead ointment mull ; the dry places are lightly smeared over with fat. If the ap-

pliance is unendurable, the disease must be treated according to the general methods already described.

## IMPETIGO.

It would perhaps be better to exclude this term altogether from the list of cutaneous diseases, but it is still used to designate two complaints—impetigo contagiosa (Tilbury Fox), and impetigo herpetiformis (Hebra).

### 1. *Impetigo Contagiosa* (*Tilbury Fox*) *s. Parasitaria* (*Caposi*).

Our mention of this disease in the present connection, and not as one of the mycoses, is justified by the fact that its parasitical origin is still undetermined. It appears most frequently in children, and especially on the face, vertex, occiput, and back of the hands, under the form of vesicles, from the size of a pin's head to that of a lentil, whose bases are usually not inflamed, and which very soon dry into gummy crusts appearing as if glued on.

These, on falling off, leave a smooth surface, free from scales. There is no pain or itching. The affection is diffused by scratching. According to Caposi, the eruption is followed by great swelling of the submaxillary glands. The complaint often attacks several children in the same family and is said to be contagious. Caposi has discovered a fungus beneath the epidermis of the vesicle, but which is always derived from without. Geber and Lang have also found a fungus and are inclined to identify this disease with herpes tonsurans vesiculosus. Taylor and Unna were unable to detect these organisms. The disease usually disappears spontaneously in from two to six weeks. Its cure is hastened by zinc and white-precipitate ointments.

### 2. *Impetigo Herpetiformis* (*Hebra*), *s. Herpes Vegetans* (*Auspitz*), *s. Herpes Pyæmicus* (*Neumann*).

Only nine cases of this disease have thus far been observed—all of them in pregnant women, and commencing in the final months. Six out of eight resulted fatally. Hebra gives the following outline of symptoms

Eruption of pustules, arranged in groups or circularly, filled with a yellow purulent liquid, and drying into yellow flat scabs, under which a red, excoriated, non-ulcerated surface is perceptible, and which are surrounded by a succession of new clusters and rings of pustules.

The pustules were always largest and most numerous on the anterior surface of the body and the inside of the thigh, but were also observed on the upper extremities, throat, nape of the neck, back, and face. In three or four months, the disease had affected almost the entire surface, which was swollen, hot, covered with crusts, and fissured and excoriated in places that were here and there encircled by pustules. The mucous membrane of the tongue showed, in one case, circumscribed gray patches, depressed in the centre. Each crop of pustules was preceded by rigors, and the patients finally succumbed to exhaustion. The etiology of the disease is still quite obscure.

Treatment, according to Caposi, consists in antiphlogistic measures, such as the application of amylum and cold wrappings, followed by soda or simple continuous baths, simple ointments, carbolized and plaster-of-Paris tar dressings, besides the use of means adapted to control the fever and the other constitutional symptoms.

## LUPUS ERYTHEMATOSUS.

This disease, first mentioned by Biett as erythème centrifuge, and in 1845 described by Hebra under the title seborrhœa congestiva, afterwards received from Cazenave (1850) the name of lupus erythematosus, by which it is now generally known.

*Definition.*—Lupus erythematosus is an inflammatory disorder commencing in the enlarged capillaries of the corium and of the papillary body and going on to infiltration and focus-like aggregation of cells; it heals spontaneously, or else terminates in degeneration and cicatrical retraction of the cutis and its glands.

I do not rank it among the neoplasmata, notwithstanding its focus-like aggregation of cells in the corium, which brings it into close anatomical relations with lupus vulgaris; still, however, I retain the name of lupus erythematosus, not considering that the real nature of this disease has yet been finally determined.

*Course and Symptoms.*—Lupus erythematosus does not usually come under medical inspection until after it has invaded a considerably extent of surface, since patients, owing to the fact that it runs its course without pain, and as a rule, without itching, either fail to notice its existence at the outset, or regard it as unimportant.

In its earlier stages, it is found to present the following phenomena:

An eruption of small, red, superficial, slightly elevated dots, varying in size from a pin's head to a lentil, and disappearing on pressure. These at first have a smooth surface, but subsequently exhibit at their slightly depressed centres, small, firmly adherent scales, which send off conical processes between the elongated papillæ, and into the enlarged orifices of the sebaceous glands.

This primary eruption may appear in one situation only, or in several places at once; the latter, especially, in malignant cases.

Its extension takes place in two ways: through the advance of the disease peripherally, causing adjacent blotches to coalesce, or by the appearance of new primary eruptions.

The coalescence of blotches produces sinuosity of the periphery as in psoriasis, since the process of recovery usually sets in where two diseased surfaces are in contact. While the disease is extending itself peripherally, its spontaneous cure, by a kind of cicatricial atrophy, commences at the centre. Here, in the course of months or of years, a depressed white and shining cicatrix is formed, or, before atrophy has fairly begun, we meet with a dry, lustreless surface covered with firmly adherent scales, which at first have a greasy feel, caused by an excessive secretion from the sebaceous glands (lupus erythematosus sebaceus), but afterwards, as the atrophy progresses, become gradually dryer and harder, until they feel like the dried skin of a snake. When the sebaceous glands are not involved or are wanting, as in the palm of the hand, the cutaneous surface exhibits these appearances from the outset (lupus erythematosus corneus). Such central atrophy, with peripheral morbid extension, gives rise to that peculiar circularly-formed exanthem, sharply defined at its circumference, but gradually fading away towards the centre, which led Caposi to call it lupus erythematosus discoides. Upon the welt, there are often numerous comedones. Several of these round spots, from the size of a lentil to that of the palm of the hand, may be present at the same time. Their growth is usually very slow, extending over periods of months or even of fifteen or twenty years. In many instances, the disease speedily covers the entire face, especially when combined with erysipelas. This disc-like form of eruption occurs most frequently on the nose, cheeks, eyelids, ears, lips, and scalp, rarely on the fingers or toes. When, as is very often the

case, the disease attacks the cheeks and nose exclusively and symmetrically, it imparts to them a peculiar appearance, compared by Hebra to that of a butterfly with outspread wings.

When hirsute parts are affected, the hairs fall off, owing to atrophy of their follicles. In the rare cases of spontaneous recovery from the discoid form of lupus erythematosus, the borders of the eruption become pale and flat, and a shining, superficial, atrophied spot remains behind, usually white, and resembling the scar left by a burn. More deeply-reaching cicatricial infiltrations are not infrequently found, especially on the auricle and the nose.

Aside from the deformity, lupus erythematosus discoides generally entails no bad results. The patient's constitution usually remains unaffected, and suppuration and ulceration never take place.

Much more malignant is that form of the disease entitled by Caposi lupus erythematosus disseminatus s. aggregatus. In this, the primary eruption is far more widely diffused. Its extension takes place through the repeated outbreak of the disease in new localities. The blotches thus produced never coalesce, even after remaining for months, but, on the contrary, may spontaneously retrogress. Caposi and others have observed this form not only on the face, head, fingers, and toes, but also on the auricle, in the meatus auditorius, on the trunk, upper extremities, palm and back of the hand, and, in rare cases, dispersed over the entire surface. It generally spreads by degrees. Occasionally, however, the complaint assumes an acute character. Caposi describes this form as follows:[1]

"The morbid process extends sometimes gradually, sometimes in the form of an acute febrile eruption, associated with nocturnal osteocopic pains, exudation in the joints, and nocturnal headache. In one series of cases, a severe swelling arose, resembling erysipelas, which, however, was confined entirely to the face. With this, there were a typhoid condition, a temperature above 40° C., coma, sopor, and a dry, leathery tongue. Half the cases resulted fatally. Along with the above symptoms, in several instances, we noticed at numerous points of the skin many hundred flat vesicles, containing either blood or a limpid fluid, such as are seen in herpes iris; these immediately dried into crusts, leaving behind them the centrally depressed formations characteristic of lupus erythematosus.

"Such acute eruptions are almost peculiar to lupus erythematosus disseminatus. They are but rarely found in connection with the discoid variety, but then this occur, also in the form of disseminated patches."

Cæsar Boeck,[2] who has observed two such acute cases, gives a very precise picture of the development of the eruption. He was unable to detect in the beginning the slightest trace of a depression or of a follicular opening in the centre of the spots. This phenomenon only develops at a later stage of the complaint.

On mucous membranes, lupus erythematosus has been observed on the lips, eyelids, the hard palate, and cheek. The lips, when thus affected, are very dry, and covered with exceedingly fine scales, resembling grains of grayish sand. Caposi found on the palate and inside of the cheeks large patches beset with bluish-white cicatrized spots, and with superficial red or grayish excoriations, from mere points to the size of a lentil.

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[1] Moritz Caposi: "Pathologie und Therapie der Hautkrankheiten," Wien, 1880, p. 609.

[2] "Zwei eigenthümliche Fälle von Lupus erythematosus disseminatus." Norsk. Magazin for Laegevidenskaben, vol. i., pp. 1–28, 1881.

*Pathological Anatomy.*—Neumann's recent clinical observation of the disease in the palm of the hand, where no sebaceous glands exist, together with the anatomical investigations of Thin, Geber, Caposi, and Vidal, have demonstrated that the sebaceous, as well as the sudoriparous glands, perform only a secondary part in its production, that, ordinarily, this morbid process commences in the corium—especially in the papillary body (rarely in the deeper cutaneous layers or in the subcutaneous cellular tissue)—with a dilatation and engorgement of the blood-vessels, and that the vascular network surrounding the glands only subsequently becomes involved. Hence, also, it follows that the parts most liable to be attacked are those most subject to engorgement and vascular dilatation during the course of other disorders (acne rosacea and congelations), as the nose, cheeks, ears, and backs of the fingers and toes. The vascular dilatation leads directly to a copious cell-infiltration and to a circumscribed aggregation of cells. An increased formation of cells, with hypersecretion of fluid, takes place in the glands. At the same time, we meet with a new formation of connective tissue and a soaking of the tissue with serum. The newly-formed cells and the connective tissue fall next into a state of fatty and hyaloid degeneration; then occur the cicatricial atrophy of the latter, the shrivelling of the glandular follicles it incloses, and the partial obliteration of blood-vessels, on which process the central depressions uniformly depend.

The epidermis exhibits a splintery state of the horny layer, with fatty degeneration and consequent cloudiness of the rete, passing at last into a condition of atrophy.

*Etiology.*—Lupus erythematosus is a comparatively rare dieease; it is more frequent among females than males. It appears in general between the twentieth and fortieth years, only exceptionally at an earlier or later period. Its etiology is still quite obscure. Diseases of the skin which are associated with intense hyperæmia are predisposing influences. In one of Caposi's cases, the malady proceeded from a nasal seborrhœa, after small-pox; we have known it to follow erysipelas; Auspitz observed it as a result of acne rosacea. In one instance, we saw it arise in the vicinity of leech-bites near the eye and on the site of a fly-blister behind the ear. It frequently coexists with scrofulosis, tuberculosis, gout, and chlorosis, and patients very often have an anæmic appearance. It is met with quite often in subjects otherwise perfectly healthy.

*Diagnosis.*—The diagnosis of this affection is generally unattended with difficulty, yet it is possible to confound it with the following:

### 1. *Lupus Vulgaris.*

Lupus erythematosus prevents small, superficial red points, on which firmly adherent scales with conical processes are produced. Lupus vulgaris begins with an eruption of brownish papules deep in the substance of the cutis. Lupus erythematosus never passes into softening, suppuration, and ulceration, and never results in nodes, like lupus vulgaris. Lupus erythematosus is always confined to the cutis and the subcutaneous cellular tissue; deeper-lying structures, as the cartilages, are never affected.

### 2. *Acne Rosacea.*

The nose and cheeks are localities common to both complaints. On the other hand, the wall, the central cicatrix, and the firmly-adherent scales, are wanting in acne rosacea, while vascular dilatation is often more prominent in that disease, and is accompanied by the formation of pustules and nodules.

### 3. *Herpes Tonsurans.*

This runs a much more rapid course and exhibits no central cicatrix; its patches are surrounded by vesicles, and its fungi are microscopically demonstrable.

### 4. *Psoriasis.*

The scales in this disease are of a silvery lustre, and their removal exposes a bleeding surface. They send forth no processes between the papillæ, and the central cicatrix is wanting.

### 5. *Circular Syphilide.*

The redness of lupus erythematosus disappears under pressure, and its outline is continuous. In the syphilide the redness is not removed by pressure, and its margin exhibits a hard, shining infiltration. The wall of the syphilide, when closely examined, is seen to be composed of single eruptive formations.

According to Caposi, aggregated lupus erythematosus in its earliest stage resembles eczema impetiginosum, squamosum, herpes tonsurans, maculosus, and even herpes iris, but is distinguished from all of these by its speedily formed central, cicatricial depression.

*Prognosis.*—This is favorable, so far as life is concerned, especially in the discoid variety, while the disseminated form is frequently attended with dangerous acute eruptions and malignant complications. Still, even these very seldom result fatally. Spontaneous and complete recovery is exceedingly rare. Lupus erythematosus is a very lingering and obstinate complaint, and hence its prognosis should always be guarded, especially as to duration, although cures are rapidly effected in individual cases. The aggregated form is least amenable to treatment. It is usually succeeded by cicatricial formations which frequently give rise to troublesome telangiectasias.

*Treatment.*—We have not succeeded in curing lupus erythematosus by internal remedies alone. Iodide of potassium, arsenic, and iodide of starch have all failed in our hands. Yet I would endeavor to strengthen the patient's general constitution as far as possible. Where we detect signs of scrofula, tuberculosis, gout, or chlorosis, treatment should be adapted to meet the indications thus presented. When none of these diatheses exist, we must be content with prescribing good air and the most invigorating diet.

These considerations tend to increase the importance of local treatment. A long list of outward applications have been tried and recommended in this intractable affection, no one of which has proved reliable in all cases. A remedy that has previously worked admirably may come to disappoint us in precisely similar cases, and this is true even of the most powerful caustics. The cauterized places, indeed, heal over, but on the other hand the disease reappears and extends itself wherever reaction occurs on the borders of the eschar. We possess no remedy that will prevent the return of the exanthem, and consequently can only keep on destroying it over and over again. Those curative measures are to be preferred which are least apt to be followed by disfiguring cicatrices.

The following remedies have been of most service in our hospital practice.

When the patches of lupus erythematosus are small and circumscribed, the iodide of mercury (at a strength of 1:5 to 15 ointment) has been productive of excellent results. After the affected spots have been cleansed from fat and adherent scales, they are thickly coated with the ointment by means of a camel's-hair brush. This is allowed to remain until the formation of vesicles filled with pus, which usually occurs in the course of six weeks, though sometimes at a later period. Then what is left of the ointment is care-

fully removed, and the vesicles suffered to dry into crusts and finally to fall off spontaneously. In some cases this application has to be frequently repeated on at least a portion of the affected surface. In this way, we have effected many rapid cures, without leaving scars.

A more energetic agent, and one especially to be recommended in the treatment of lupus erythematosus cornens, is chloracetic acid. This is valuable on account of its rapid yet not too penetrating action, which causes but little pain and is confined within the exact limits of the application, the slight degree of inflammation it excites in the vicinity, and the smoothness of the resulting cicatrix. It is decidedly preferable to most other acids. It is laid on with a glass rod and speedily forms a white eschar; into this is bored a pointed glass rod dipped in the acid.

When larger surfaces are to be acted upon, we prefer the use of pyrogallic acid. This is applied in the form of an ointment (1 : 10 vaseline) which is spread upon linen, or in that of Unna's gutta-percha plaster mull (15 gm. pyrogallic acid pro 1–5 qm.), and is kept on for three or four days, until it has produced a superficial brownish eschar, which is covered with an iodoform bandage and left undisturbed until it sloughs off. The diseased parts are powdered thickly with iodoform and dressed with iodoform gauze. Iodoform gutta-percha plaster mull, 10 gm. pro 1–5 qm., is also useful on small patches, but not on more extensive surfaces, since it does not absorb the abundant discharge. Iodoform not only prevents reaction in the neighborhood, but has also a decidedly curative effect on the lupus erythematosus.

The result of this combined treatment is often surprising.

When these measures fail, we should not have recourse to the curette, which always gives rise to speedy relapses, but should rely upon the deeper-reaching operation of pricking, as recommended by Volkmann.[1] This is done with a sharp lancet, or, more rapidly, as proposed by my brother, Dr. E. Veiel,[2] with an instrument formed of six lancets set closely together. The skin is pierced by hundreds and thousands of punctures arrayed as densely as possible in manifold intersecting lines, so that it looks as if hacked in pieces, and has a peculiar pale, livid hue. The use of the knife is far more difficult in cases of lupus erythematosus than in lupus vulgaris. After arresting the flow of blood by pressure with antiseptic sponges, an application of iodoform powder is made. As a rule, the pricking has to be frequently repeated in order to obtain a complete cure. Small surfaces may be anesthetized by the use of Richardson's ether vaporizer; on larger ones, chloroform must be employed. The *scarifications linéaires quadrillées* introduced by Vidal[3] are also very effectual, when combined with the application of iodoform.

This process consists in making, with a double-edged knife, resembling a cataract-needle, several parallel incisions as close to one another as possible, but not quite penetrating the cutis; these are crossed by similar ones at right angles, so that the entire surface appears as if traversed by deep furrows.

Caposi testifies to very favorable results from the employment of the gray emplastrum hydrargyri, which, however, must be kept applied for a long time; according to him, it is of special service in the aggregated form of the complaint. He has likewise effected numerous cures by frictions with spiritus saponato-kalinus. After the use of this remedy, Neumann covers the skin with white precipitate ointment (1 : 8). When

[1] "Sammlung klinischer Vorträge," No. 13.

[2] Archiv für Dermatologie und Syphilis, p. 278, 1873.

[3] "On Lupus." Gaz. des hôpitaux, 22, 27, 33, 35, 1879.

time permits, a trial of this remedy is advisable. As to the merits of the naphthol paste recommended by Caposi (naphth. 5 : starch-flour 100, applied as a paste daily, for three days in succession, until a brown eschar is formed), or of the collodion of mercurial sublimate proposed by the same writer and by Boeck, experience does not justify us in offering an opinion.

# DEEP-SPREADING INFLAMMATIONS OF THE SKIN.

## A. ACUTE DEEP-SPREADING INFLAMMATIONS

BY

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IN KLAUSENBERG.

### ERYSIPELAS.

Erysipelas has already received detailed consideration in another part of this handbook (Vol. II.). The subject is again presented, on account of its natural connection with the other affections of the skin. It is our purpose to define, in a concise manner, the present doctrine of erysipelas from the dermatological standpoint.

I will remind you at the start that many very valuable doctrinal views, which modern investigations have proven to be correct or acceptable, had been expressed by the old Greeks, Latins, Arabians, and by the writers of subsequent centuries. Nevertheless, accurate as are the descriptions of our predecessors, and much as they testify to conscientious observation at the sick-bed, their standpoints are not always the results of objective examination, inasmuch as they often, even in essential points, confound cause and effect and the like with one another. Among the number of false conclusions, I will point merely to the following illustration. Because the disease often begins with gastric symptoms, the conditions producing these were formerly regarded as producers of the erysipelas. To-day we are far from assuming that the disturbed secretion of bile, the thin or acrid, spoiled, warm humors, the interference with the functions of the intestinal tract, or the ingestion of articles of food which are digested with difficulty, and the like will produce erysipelas. In like manner, we may regard as dispelled the erroneous conception that the disease is the result of suppressed bloody and mucous fluxes, disturbed perspiration, and violent mental excitement. Nor can scarcely any one be found among us who regards it as a deposit—apostasis—upon the surface, which Nature employs for the excretion of a dross, a materia peccans.

On the other hand, there are a number of prominent medical clinicians who have retained so much of tradition that they assume an autochthonous, medical erysipelas, developing from general infection, and place this as E. spontaneum, idiopathicum, or verum in opposition to E. chirurg., traumaticum, spurium, or nothum, which originates from an injury.

But since an impetus has been given to the observation of the local conditions in every outbreak of erysipelas, the proofs are increasing that the disease requires a point of entrance, which has been produced in a traumatic manner, and that thence it obtains its further spread; and that when investigation in this direction proves barren of results, this is due to a slight injury—erosion—to the lesion remaining concealed or unnoticed.

My observations render such conclusions very probable. Among the 72 cases of erysipelas which occurred in this clinic, 8 occurred during their stay in the hospital, after buboes and ulcera cruris, varicos. and specifica; 64 developed outside. Among these the starting-point of the disease in a local affection could be demonstrated 51 times with certainty; 6 times no decision could be reached, as the injuries of the skin and caries of the teeth did not coincide in point of time with the erysipelas, and in 5 cases no explanation could be offered.

Furthermore, as I find in the course of erysipelas no plausible reason for the assumption of two independent forms, I, for my part, do not hesitate to recognize but one variety, which is due to a solution of continuity as an exciting cause, *i. e.*, traumatic erysipelas. Whether, however, there is not a spontaneous idiopathic erysipelas of the internal organs, in the sense which Hippocrates first expressed with regard to wandering pneumonia, and has since been described by Virchow, Friedreich, and others, I am unable to determine on account of the lack of suitable material.

Accordingly, I mean by the term erysipelas of the skin a, on the one hand, general intoxication, and on the other hand, acute progressing inflammation with predominant serous infiltration of the tissues, associated with febrile movement, and produced as the result of local infectious action; after desquamation of the epidermis this terminates constantly in a restitutio ad integrum.

*Symptoms and Course.*—Its first symptoms: tired feeling in the limbs, anorexia, headache, burning or pricking pain in the affected part, are manifested either before or with the appearance of the erysipelas, and the disturbances on the part of the general condition and those of the lesion may occur either to an equal extent, or those of the one may predominate over those of the other. Usually, however, the patient only becomes conscious of the significance of his condition when, in addition to the unpleasant local sensations, he is attacked by a chill. There is no objection to regarding these processes as a prodromal stage, as the attack is indeed introduced by them.

The symptoms which now make their appearance are those of an undoubted toxæmia and of an inflammatory irritation in the part affected. The first is manifested by the relatively high fever, which is out of proportion to the local affection, by the gastric symptoms, coated tongue, anorexia, pain in the stomach, nausea, vomiting, constipation, or diarrhœa, by irritation of the cerebro-spinal system, headache, delirium, coma, hallucinations, tremor, and the possibly associated disturbances of the circulatory, respiratory, and other organs. With regard to the affection of the skin, we notice a rosy to blood-red spot, which grows pale under the pressure of the finger, and has either zigzag or uniform sharply defined borders; it starts either from a trifling excoriation, an insignificant pustule, or from a part which has healed, and in not very rare cases, from a spot which, in view of its remoteness from an inflammatory focus, may simulate a spontaneous development.

The erysipelatous patch is characterized by its striking sensitiveness, serous swelling, tension of the skin, shining exterior, and the tendency to superficial spread.

If the transudation occurs in large amount, the œdematous swelling becomes greater, and the elevations and depressions of the skin appear more distinctly. This

becomes especially noticeable in cicatricial spots, inasmuch as they appear elevated and markedly swollen. If the quantity of exuded fluid increases to a considerable degree, it terminates in separation of the epidermis or the formation of vesicles; after these have existed for some time, the contents become cloudy or change into crusts. These phenomena have no special significance apart from those vesicles with sero-bloody contents which occur in E. gangrenosum.

In the mildest cases, the erysipelas terminates with a single outbreak of this character. The redness of the skin first grows pale at the periphery, and then over the entire area; the fever ceases in the next few hours, and the patient feels well in one to three days. In moderate cases, the extension of the local phenomena continues for a few days, then stands still, and retrogression occurs, so that, at the end of a week, the desquamating epidermis alone reveals the last traces of the erysipelas. If the erysipelas occurs in a more severe form, the processes in the skin become important, the subcontinuous fever continues for some time, or even increases, and the general condition is considerably disturbed. We must, however, abstain from a detailed consideration of all the disturbances of the general condition. A part of them will be considered later, so far as it is necessary to a comprehension of the whole, and as for the rest, we refer to Vol. II. of this handbook.

But we will devote a few words to the relation of the fever to erysipelas, because it is very often of great importance with regard to the termination, is its constant accompaniment, and generally runs parallel with it. It announces the erysipelas at its appearance, and ceases only with the termination of the disease. Beginning with a temperature which often rises to 40°, it generally remains stationary for some time, according to the processes in the skin; with the cessation of the local phenomena, it becomes subnormal, or if the former increase, it may rise exceptionally even to 42° (Wunderlich). In erysipelas running a regular course, the fever shows morning remissions, and reaches its former height during evening and night. It becomes irregular when the process leaves its normal course, as in erysipelas migrans, and that form, E. diuturnum, which is more prolonged. Then it may happen that an abnormally high increase of temperature is followed by a sudden fall, and soon afterwards by variable temperatures of 38° to 40°. If the fever ceases entirely, the other concomitant symptoms also grow less, and euphoria occurs, introduced by a profuse secretion of perspiration. If the fever does not diminish after a number (eight) of days, the bad symptoms will persist uninterruptedly, and we must expect the occurrence of complications.

In otherwise healthy individuals, the pulse conforms equally to the local disturbances. It is strong, full, and frequent so long as the course of the erysipelas is turbulent but normal; it becomes small, feeble, dicrotic when the process is irregular and cardiac complications are present.

The spread of the erysipelas occurs, as a rule, inasmuch as the zigzag, tongue-shaped prolongations of the sharply-defined borders seize upon new tissue uninterruptedly and on all sides. This occurs sometimes slowly (1–3 cm. daily), sometimes more rapidly (up to 30 cm. daily), and affects either large parts of the body or the entire integument, and it sometimes happens in cases of unusual extension that previously involved localities again become affected, and thus the subject of a second or third eruption, which may prolong the duration of the disease to three to six weeks.

If the borders finally become obliterated in a diffuse manner, there is hope of the occurrence of a standstill. But it may happen that, in cases which had already undergone retrogression, the hidden glimmering fire is suddenly fanned into a flame without

any known cause, and the reappearance of a chill furnishes the signal of further trouble. It cannot be predicted at the start what form the erysipelas will assume in its subsequent course. The mildest grades are often followed by the most severe, and *vice versa*. In like manner, we are generally unable to predict the direction in which the erysipelas will spread. As the observations at the sick-bed teach, however, a certain regularity appears to be imposed upon it in so far as it accommodates itself according to the cleavage of the skin determined by Langer, and is partly modified, partly stopped at the nodular points. Therefore, no serrations are observed upon the hairy scalp, the palms of the hands, and soles of the feet, therefore the chin, base of the skull, and Poupart's ligament are commonly avoided by erysipelas, and for this reason a slow progress is observed at the condyles of the joints, the crests of the ilia, etc.

Exceptionally, erysipelas may make smaller or greater leaps. If the part which has remained unaffected between the individual erysipelatous spots is small, no significance is attached to it. But matters assume a different aspect if the erysipelas, for example, has been situated on the trunk and then appears suddenly on the forearm or leg. Then it must be earnestly considered whether both foci belong to one and the same source or not. If it can be proven that the process has extended to remote parts, leaving the intermediate parts free, it is possible that in the diffusion of the deleterious substance, some parts of the tissue will allow it pass through them without being injured, while others react more vigorously and thus become erysipelatous. For the present, however, the statement advanced by Volkmann, that this remote appearance of an erysipelatous patch is the result of a metastatic deposit, cannot be denied. This form is known as E. erraticum. If it is proven, on the other hand, that separate erysipelatous foci are present in two or more spots, we have to deal with an E. duplex, triplex, and multiplex.

If intervals of complete apyrexia and retrogression of the inflamed tissues occur between the eruptions which follow one another, the erysipelas is a relapsing one and, if it recurs a number of times in the parts in question, an habitual one. The latter form acquires increased interest from the fact that its products themselves constitute the material for its future recurrence, *i. e.*, without any special exciting cause, and for changes in the tissues. The significance of such an habitual erysipelas to the patient is evident from the fact that he is not alone ignorant of when he will be affected by an attack, but to his discomfiture finds them increasing from year to year, not alone in frequency (nine to twelve a year), but also in severity.

Fortunately such unfavorable terminations are rare, despite the fact that individuals who have once suffered from erysipelas are especially predisposed to it. As a rule, the inflammation of the skin disappears completely, the exudation is absorbed, the normal color returns, the swelling of the lymphatic glands of the affected parts disappears, and after the branny or membranous desquamation of the epidermis[1] has ceased, restitution follows in the strictest sense.

Apart from the variations mentioned in the course of erysipelas, there is an entire series of noteworthy factors which are associated mainly with the local conditions. For the sake of completeness, some of them will here be considered very briefly.

*Erysipelas of the Face.*—Facial erysipelas which, as is well known, is the most frequent form, may have its starting-point in any part of the face. But experience teaches that it arises most commonly as the result of catarrhal, ulcerative, and other affections of

[1] Only recently, as a companion piece to George Wilson's observations, I have seen the epidermis of the foot desquamated literally as a whole after a severe erysipelas of the leg.

the nasal mucous membrane, syphilitic or scrofulous caries of the nasal bone, ulcerative processes of the pharynx, lupus, syphilis, etc., of the alæ nasi, carious teeth, many forms of otorrhœa, conjunctival catarrh, and morbid changes of the Meibomian glands. We must regard it as a special local phenomenon that, on account of the loose, large-meshed tissue of the cutis, a large quantity of transudation accumulates more readily in the stroma, on account of which the expression of the face appears frightful, and the process in general more violent. If the face is affected in its entirety, the eyelids are very œdematous and closed, and the skin in the vicinity is eroded or eczematous on account of the flow of tears. The nose becomes shining, markedly swollen, and painful, the nostrils dry, often impervious on account of crusts. The lips are thickened to twice their size, the conchæ are very tense, stiff, shining, and bright red ; the integument of the cheeks and temples is infiltrated to a considerable extent, and often presents vesicles. Facial erysipelas usually ends favorably, even the destructive process which has occurred in the eyelids on account of the infiltration usually heals without any disfiguring cicatrices. Now and then inflammation and suppuration of the parotid or the neighboring glands occur, but have no further consequences apart from the prolonged duration. Facial erysipelas only attains special significance from its spread to the scalp or from the orbits to the meninges.

*Erysipelas of the Scalp.*—If erysipelas affects the hairy part of the head, this is manifested from the beginning by the dull and later more acute, but always constant headache, which is due not alone to the tension of the cutis and galea aponeurotica by the exudation, but also to the change in the amount of blood in the cerebral vessels.

In very irritable individuals, insomnia, delirium, etc., may occur even in moderate grades of erysipelas, and when the fever is by no means high. But as soon as the erysipelas subsides, the patients grow quiet, consciousness returns undisturbed, the swelling of the scalp disappears quite rapidly, and an obstinate seborrhœa alone remains, associated with defluvium capillorum extending over the entire scalp, and which is usually the result of a serous infiltration. As a rule, some hairs begin to grow while the others are falling out.

If the erysipelas and high fever continue undiminished, violent cerebral symptoms appear very soon ; the pulse becomes slow (60) or rapid, the pupils react slowly or become almost immovable, and the sensorium is usually dull. Maniacal attacks, violent jactitations occur, and are followed commonly by coma and sopor. The patient lies in an apathetic condition, mutters incoherently, and dies with symptoms of convulsions, gnashing of the teeth, muscular tremor and the like, if no change for the better occurs within eight to ten days. Purulent inflammations of the brain and its membranes, encephalitides, meningitides, purulent phlebitides, metastatic process, and, in general, extension of the erysipelas are found exceptionally, much more rarely than is commonly supposed. In the majority of cases, œdema of the brain is alone observed. To what extent, however, the continued or high fever, the intoxication, the reflex irritability, and the like take part in this process has not been determined hitherto.

On account of this serious condition, erysipelas of the scalp has always been more dreaded, and for this reason even the slightest surgical operation upon this part must be made with the greatest care.

*Erysipelas of the Trunk.*—This occurs more frequently as the result of extension of the disease than as a primary local affection. In the overwhelming majority of cases, the exciting causes of the latter form are serious operations (removal of the mammary glands in fat individuals), neoplasms undergoing degeneration, fistulous tracts and caries

of the ribs. In the new-born, it is often observed after the falling off of the umbilical cord. It must always be regarded as a serious disease, on account of the frequent inflammations of the serous membranes (peritonitis, pericarditis, pleurisy) and of the other organs (lungs, heart, intestines, etc.).

Among the forms of erysipelas of the trunk, the following possess a greater amount of interest:

1. *Erysipelas of the Umbilicus,* which occurs almost exclusively in the new-born, is caused usually by all sorts of irritation of the umbilical wound. During puerperal epidemics it occasionally occurs epidemically in foundling asylums and hospitals. It is signalized especially by its wandering character, and the malignancy of its course. At the beginning, an irritated spot is observed upon the umbilicus; upon this an erysipelatous patch of varying size develops, upon the slightest contact with which the infant cries out loudly. Parallel to this condition is the course run by the fever, which is moderate at the onset, but increases with the spread of the process. If a standstill of the erysipelas does not occur within a few days, the life of the child is seriously endangered. The children die within three to twelve days from loss of vitality, anæmia, etc., on account of the continued fever, the later suppuration of the tissues, and the gangrene in the vicinity of the umbilicus. Or the erysipelas is complicated by peritonitis, enteritis, pneumonia, and the like, and the fatal termination then occurs at a later period, but is no less probable. Trousseau states that the disease is absolutely fatal, and Steiner has seen a favorable termination in only two cases out of sixty. Bednar, on the other hand, regards recovery as the more frequent result.

2. *Erysipelas of the Genitals.*—Upon the male and female sexual organs, apart from certain operative procedures, the kinds of diseases which result from the constitution of these parts serve as the chief exciting causes of erysipelas. In males, this includes the fistulous tracks of the urethra and the scrotum which result from strictures and perurethral abscesses, the specific ulcers, and various ulcerative processes. In such cases, the foreskin of the penis is considerably swollen, and may enlarge to such an extent that the head of the penis cannot be reached, and the orifice of the urethra is closed. The result is that the urine is only discharged in drops and constantly trickles upon the surroundings parts. This leads not infrequently to the production of extensive deeply spreading gangrene, which may dissect out the testicles. Recovery occurs very soon after a standstill has taken place. In adult females, erysipelas of the vulva is caused by uncleanliness, decomposition of the secretion of the vagina and of ulcers, and in little girls who suffer from aphthous and follicular ulcerations on account of neglect, from the action of the urine and fæces.

3. *Erysipelas of the Extremities.*—Next to erysipelas of the face, that of the extremities is observed most frequently. According to Billroth (Zurich Clinic, 1860–1870), among 248 cases, 123 occurred upon the limbs, 67 in the face, 13 on the scalp, 43 on the trunk.

According to the majority of reports, it occurs more frequently in the lower than in the upper limbs. This is explained not alone by the fact that all kinds of exciting causes, ulcerations, etc., appear more frequently on the lower limbs, but also by the fact that, on account of the circulatory conditions, injuries in this region heal more slowly, and present a greater tendency to an increase of the inflammatory process. Nevertheless, Tillmanns is certainly right when he asserts that the statistics bearing on this point depend in part upon the varying character of the material of observation at the command of individual writers. Erysipelas of the upper limbs is observed with relative frequency in

carpenters, butchers, carriage-makers, physicians, nurses, and that of the lower limb in blacksmith, tanners, servants, and the like. The children's physician, and particularly one connected with a hospital, sees more affections of the arm,[1] on account of vaccination erysipelas, while the physician to a penal institution treats more cases of erysipelas of the legs.

The course of erysipelas of the extremities is, on the average, favorable in adults. It is attended with more serious results when, on account of its extension, the joints become implicated, or when, as in the gangrenous form, extensive destruction of tissue develops, and secondarily, contractures which impede the functions of the limb.

*Complications of Erysipelas.*—In view of the violent and manifold effects of the erysipelatous process on the vital conditions of the entire organisms, it is conceivable that deviations from the normal course, or disturbances of the most varied kind often develop. They may begin on the first day of the disease, or appear at any time during its continuance. A part of the complications has been mentioned in the description of the symptomatology. We will now consider those forms in which suppuration and necrotic degeneration of the tissues result. The simplest variety consists of the unimportant superficial little abscesses which appear along the erysipelatous skin, often as early as the end of the first week, and spontaneous or artificial discharge of which is sufficient to cause them to heal. If the erysipelas remains for a longer time, or recurs in one spot, multiple depots of pus, sometimes extending into the subcutaneous connective tissue, develop. If they are not too numerous, and the constitution of the patient is tolerably vigorous, they have no further significance beyond the results of a slight febrile movement. They heal by surgical interference (incision and careful bandaging) within a short time. These abscess formations should not be mistaken for those which appear during convalescence, or even after the lapse of weeks as the results of metastasis of the skin, the lymphatic glands, or other localities. These may remain unnoticed for a long time, are manifested finally with the symptoms of cold abscesses, are attended usually with febrile movement, and almost without exception develop deep in the tissues. Usually, also, these collections of pus are followed by no evil results.

Much more important are the destructive processes which are the results of a too profuse and abnormal exudation. After fever and general malaise, the skin usually becomes markedly infiltrated with œdema, very painful, discolored, and vesicles filled with sero-bloody contents sprout out upon the surface; beneath these are concealed the first

[1] As one of the weapons employed by the opponents of vaccination, use is made of the bad complication with vaccination erysipelas. I believe, however, that this accusation is carried too far, since it is observed very rarely after private vaccination, more frequently in foundling asylums and institutions of this character, in which, on the one hand, the number of children who are cachectic at the start, on the other hand, the spatial conditions and the more ready communicability, constitute so many predisposing factors. It may occur upon any day, from the completed vaccination of the lymph to the entire healing of the vaccine pustule. In the majority of cases, however, it occurs during the second week, *i. e.*, during the stage of maturity. Its course is not different from that of erysipelas which has developed from some other cause, inasmuch as it may remain localized or attack parts of varying dimensions, even the whole body. In healthy, vigorous children, if they are not too young, the process, as a rule, terminates favorably; in infants in public institutions the mortality is large (30%). Exhaustion must be mentioned as one of the most frequent causes (often more than 50%) of death, particularly after E. ambulans. With regard to the causes of vaccination erysipelas, we think it may be assumed that, when the predisposition is present, the exciting cause is furnished by the vaccine matter employed, as well as by morbific agents brought from the outside by means of instruments, uncleanliness, etc.

beginnings of mortification. If it soon becomes limited in its further course, the loss of substance will assume importance on account of its situation alone (eyelids, scrotum). In rarer cases, the gangrene causes important destruction, and may thus become the cause of various other complications. There may also be a deviation in the quality of the exudation, inasmuch as an exudation, which is in the main plastic, is added to the previously serous one. The skin thereby becomes as hard as a board, is of a bright-red to bluish-red color, and extremely painful. The result of this is the shred-like death of the corium, fasciæ, etc. Especially during severe erysipelas epidemics, the phlegmonous complications are not rare, and many a case of impaired mobility of a limb traces its origin to a contracture which has developed therefrom.

As a common course is often pursued by the erysipelatous and phlegmonous inflammation, and as a diffuse spread may be observed in both instances, both processes have come to be regarded as identical by various writers (Virchow, Tillmanns, and others). This assumption does not appear to me to be well founded; so long as the cause of both (at least in the majority of cases) is so different, and their characteristics vary so greatly from one another, I think that I may properly maintain the separate specific nature of each. We might, with equal justice, include in this category the hospital gangrene occasionally associated with erysipelas, and it would also be justifiable to regard lymphangioitis, phlebitis, and osteo-myelitis (Virchow) as erysipelatous processes.

With regard to the general condition, the typhoid stage should be regarded as one of the most serious complications. About the time that a retrogression of the disease should be expected—on the seventh day, on the average—the fever and high temperature occasionally remain stationary, without any corresponding cause being present on the part of the affection of the skin. In such cases, the pulse is accelerated, more rarely slow (sixty), small and dicrotic, the tongue is dry and fissured; the passages diarrhœal and stinking, the abdomen distended, the skin covered with a clammy sweat; the emaciation is considerable. In otherwise healthy individuals, improvement takes place quite often; the majority, however, die of adynamia towards the end of the second week.

Among the more frequent complications of erysipelas we may mention: meningitis, pneumonia, pleurisy, endocarditis, pericarditis, peritonitis, enteritis, nephritis, and synovitis, by which one or more organs may be affected simultaneously. In general, on account of the propagating character of erysipelas, the organs which are situated nearest to it are specially predisposed to implication, and therefore, for example, in erysipelas of the abdomen the peritoneum and the coils of intestines are affected in preference; in that of the chest, the serous membranes, heart and lung, etc. But this by no means excludes the quite frequent affection of organs which are situated more remotely from the inflammation.

*Etiology.*—I regard every kind of erosion, fissure, pustule, open or concealed wound and injury as an occasional cause of erysipelas. However, the simple existence of such affections is not sufficient for the production of erysipelas, but certain other exciting causes must be associated therewith. Experience at the sick-bed has taught us that open wounds present a changed appearance even before erysipelas develops. Everything forces us to the assumption that a special process occurs which then unfolds its deleterious effects.

The question then is, What is the nature of the process which lies at the bottom of erysipelas? Hebra, Kaposi, and others assume that it is the secondary chemical products of the local inflammation which, when absorbed, produce this zymotic disease. Roser favors its miasmatic nature, while the overwhelming majority of pathologists of the pres-

ent day favor its contagious nature. They call attention to the observation that erysipelas in hospitals spreads preferably to the adjacent beds, that occasionally a single imported case is followed by entire epidemics, and that finally several cases of erysipelas may follow one another in families. Cohnheim regards erysipelas as a miasmatic-contagious disease.

A number of investigators have introduced erysipelatous fluid, pus, and ichorous masses into the skin of man and animals, in order to determine the communicability of erysipelas. But all these exhaustive experiments have furnished no harmonious results. For while some have attained only a negative (Max Wolf, Stark, Hiller), not marked (Ponfick), indeterminate (Belieu, Zuelzer), or, at the most, a partial result (Tillmanns), others are said to have succeeded in producing legitimate erysipelas by means of putrid mixtures (Orth, Lukomsky). My attempts at communication have proven entirely unsuccessful. Only on one occasion after a superficial injection of six drops of fresh fluid, I observed a redness in the vicinity about as large as a two-dollar piece, which developed in a few hours with an elevation of temperature scarcely worthy of mention, and which disappeared at the end of twenty-four hours. Nevertheless, I cannot undervalue the few but undoubtedly positive experimental results, as they are also supported by the clinical facts.

Orth, with the aid of his experimental results, expressed himself in favor of the direct connection of erysipelas with cocci vegetations. And Lukomsky, who studied this subject carefully, states that in spots of erysipelas the bacteria are found in the lymphatic vessels of the corium and the subcutaneous connective tissue and at the borders exclusively in the blood capillaries. Billroth and Ehrlich were unable to discover cocci in every case of erysipelas. According to Tillmanns, the presence of cocci is by no means necessary to the erysipelatous process, although these were always present in the successful vaccinations of erysipelas fluid; on the other hand, not every coccus-containing fluid produces erysipelas. He concludes, therefore, that erysipelas occurs with and without fungus vegetations, and that the poison may be transmitted by a fluid containing cocci as well as one free from them. Very recently R. Koch, and soon afterwards Fehleisen, have expressed themselves in favor of a specific pathogenic micrococcus, which has its habitat in the lymphatic vessels of the skin and subcutaneous connective tissue.

The proofs which have been advanced of the specific nature of the erysipelas micrococci do not seem to me to be sufficient. The observations that erysipelas starts occasionally from completely healed, cicatricial parts of the skin or from the most heterogeneous inflammatory and purulent foci, on the one hand, renders the assumption of its autochthonous origin superfluous and, on the other hand, distinctly favors the view that the cocci are not an indispensable requisite for its production. According to my conception, a deleterious substance is produced under specially irritating influences, either in loco or it reaches the inflammatory spot from the outside and produces erysipelas in predisposed individuals.

Sex, age, the season of the year, the weather, telluric conditions, and the like are usually mentioned as predisposing factors of erysipelas. With regard to the first three, a series of tables gives the following results. Among my 67 patients treated at this clinic, 26 (38.8%) were males and 41 (61.2%) females. Almost the same proportions are shown by five annual reports of the Vienna General Hospital. With reference to age, among my patients, 17 occurred before the 20th year, 20 between 20–30 years, 10 between 30–40 years, 16 between 40–50 years, and 4 cases between 50–60 years. With

regard to the season of the year, among my patients 9 developed in January and December, while April and May showed the next highest figures.

But I consider these figures as much too small to draw any definite conclusions. I am not in the position to command figures with regard to the climatic and telluric conditions, but I know from experience that erysipelas appears very frequently in some marshy and maritime districts (the mouth of the Nile).

*Anatomy.*—After a few hours, the skin of a patient who has died of erysipelas can be distinguished in no respect from that of another corpse. The swelling which was present during life has disappeared, and the skin appears pale. But even the microscopical examination shows scarcely anything which is characteristic, the appearances being similar to those of a superficial or deeper dermatitis. If the part to be examined microscopically comes from the period of acme, we find most constantly starting from the papillary layer through the entire cutis into the subcutaneous cellular tissue, round-cell infiltrations which either follow the branches of the dilated, here and there thrombotic vessels or are collected in larger or smaller groups. In addition, the connective tissue is loosened, moist, and the connective-tissue corpuscles in a condition of irritation. According to Renaut, the adipose tissue in severe erysipelas passes into an embryonic condition and later takes part in the hardening of the tissues. Opinions are divided with regard to the occurrence of cocci. Tillmanns, Amidon, Hiller have missed them entirely; Billroth, Lukomsky, Ehrlich, and others have observed them quite often, Hueter, Orth, R. Koch have found them regularly. R. Koch and Fehleisen have observed them chiefly in the lymphatic vessels in the boundary zones.

Frequently no abnormality is found in the internal organs. If they are the site of the disease, this or that organ will present a variable grade of inflammatory change, according to the occurrence of the erysipelas. However, all these pathological processes (pneumonia, pleurisy, pericarditis, endocarditis, myocarditis, myositis, parenchymatous nephritis, and the like) present absolutely nothing which is peculiar to the preceding disease, but the changes produced thereby are like the appearances which are usually found in high continuous fever, toxæmia, and metastases.

*Diagnosis.*—The symptoms of erysipelas are of such a marked nature that a mistake cannot easily occur. A cause of error may be found in some varieties of erythema (gyratum, urticatum), but very marked pruritus is then present, and there is no spread per contiguum, nor the evidence of inflammatory infiltration. Now and then extensive lymphangioitis and phlebitis may render the diagnosis difficult; indeed, some authors regard erysipelas simply as capillary lymphangioitis. However, the streaked appearance of the redness and swelling, which continue even during its course, render it possible to recognize the process.

*Prognosis.*—Patients of a healthy constitution and in middle life will pass through a severe erysipelas better than under the opposite conditions. The outlook is also more favorable if the erysipelas starts from a slight solution of continuity, while important injuries, constantly suppurating wounds, the puerperal condition, vaccinia, and erysipelas of the umbilicus in infants always render the termination more serious. Whether the erysipelas occurs sporadically or epidemically, and, in the latter event, the character of the epidemic, are important factors.

The mortality in erysipelas depends upon special conditions. It is usually stated to be ten to fifteen per cent, but it changes from year to year in one and the same place.

*Treatment.*—After the elaborate presentation of the treatment of erysipelas in Vol. II., I think that I may abbreviate somewhat in the following remarks, especially as we

are generally unable to check the progress of the disease, and on this account the large number of remedies recommended are of problematical value. Even chloride of iron, aconite, veratrine, iodide of potassium, camphor, benzoate of soda, etc., cannot be regarded as anti-erysipelatous remedies, since they have not maintained their hold, despite all theoretical assumptions.

On the other hand, all kinds of local but less active antiphlogistics are preferably prescribed, even at the present time, by skilled physicians. Pencilling with solid camphor, compresses of Goulard's or some other lead lotions, the application of slices of potato, and the like, may always be employed. Their effective feature is the abstraction of heat, and they thus cause an agreeable sensation to the patient. This is true also of simple cold compresses. In recent times, it has become customary on the part of many to apply ice to the parts affected with erysipelas. As it only diminishes the local feeling of heat and the swelling and tension of the skin, but has no influence on its further course, it should only be applied in such a locality and for such a length of time as it is well tolerated by the patient. Extensive infiltration constitutes at least a partial contra-indication to the employment of ice, since this favors the obstruction of the circulation, and later, perhaps, the development of gangrene. In general, therefore, we should make it a rule never to employ the ice continuously, but only at intervals. Currie and Schoenlein have employed cold in the form of cold douches and baths. When the fever is persistently high, especially in the typhoid stage, these diminish the temperature for some hours, and, therefore, act as a palliative, but possess no direct influence upon the erysipelas itself.

With the method of treatment just described is ranged naturally the local derivative method which came into vogue towards the end of the last century. At the present time, nitrate of silver and strong tincture of iodine are alone employed. Recently I have again tried the former in substance and solution (1 : 40) in seven cases. Though I tried this plan faithfully, I was unable to secure a decided result. Nor did I have better luck with the strong tincture of iodine. During its employment, also, a circumscription of the erysipelas and diminution of the fever were observed occasionally, but no decisive results were obtained.

Since the view of the local parasitic character of the process has gained ground, the attempt has been made to combat it by various remedies, directed immediately against this element. Concerning the action of a number of them, I am able to report from personal experience. I have observed no good results whatever from the use of tar (Hueter). With regard to oil of turpentine, I remember vividly how my auditors were delighted with the first apparently brilliant results, but soon disappointed to a corresponding extent by other unsuccessful attempts. Whether the mixture recommended by Kaczarovski (Acid. carbol., 1 part; Ol. terеb., 10 parts) is more effective, I am unable to say in the absence of personal observation.

In order to bring the active substance in closer contact with the erysipelatous part, Hueter has recommended subcutaneous injections of a two to three per cent solution of carbolic acid. Several (up to five) injections are made in the healthy tissue, along the circumference of the erysipelas, so that the entire tract is thus inundated by carbolic acid. Hueter, Schueler, Hirschberg, Boekel, Aufrecht, and others have obtained satisfactory results therefrom, while Pick, Obalinski, Bardenheuer, and others have found that the spread of the erysipelas could not be prevented.

Petersen has recently extolled the virtues of salicylic acid in subcutaneous injections. In two patients, I employed iodoform in sulphuric ether (1 : 15), injecting from three

to six drops into several places along the periphory. The erysipelas ran a favorable course in both cases, but I am unable to determine whether post hoc or propter hoc.

In my opinion, expectant, symptomatic treatment of erysipelas is the best, if no other special indication is present. Apply cold compresses, because usually they are well tolerated and eagerly asked for by the patient. If crusty deposits are present at the places of eruption, we must be careful that these are removed by emollients (salves), and in larger wounds that the pus has a free avenue of discharge (drainage). In addition, the patient should be placed in a spacious room, and the air frequently changed. In high fever, give quinine and also iron if the feeble condition requires it and the condition of the digestive organs permits. If the fever has diminished or ceased, give light but good nourishing food and old wine to the extent which is well tolerated by the patient. This plan will meet the indications in the majority of cases. If complications occur on the part of any organ, these must be treated according to the nature of the disease.

## PHLEGMON.

A large majority of English writers disregard phlegmon as a morbid genus, or discuss it simply under the head of cellulitis. By the majority of French writers, it is described as Erysipèle phlegmoneux. For a long time, German authors have also been divided into two camps. While Stromeyer, Virchow, and others do not recognize it as an independent disease, the majority of pathologists express themselves in a different sense. Virchow not alone considers erysipelas and phlegmon as allied, but numbers with them thrombophlebitis and an entire series of puerperal processes, and hopes that osteomyelitis and infectious pyelonephritis will be included in the same category.

For my part, I concede willingly that in certain respects, erysipelas and phlegmon run a parallel course, and that the diagnosis must often remain doubtful. But such cases are opposed by a much larger number, in which the etiology, the different character of the symptoms and termination, furnish so many arguments for continuing to keep them separate.

*Definition.*—A phlegmon must be regarded as an acute inflammation of the subcutaneous cellular tissue, produced in a mechanical, chemical, or thermal manner, which leads to suppuration and mortification of the tissues in the large proportion of cases.

*Etiology.*—Among 341 cases, I find that exciting causes were demonstrable 135 times (139.58%). Among these were 35 superficial injuries (erosions and incised wounds), 52 deeper injuries (wounds from operation, contusions, fractures, phagedænic ulcers, and the like), 21 thermal effects (combustiones and congelationes), 7 bites of insects, 6 dissecting wounds, and 15 cases of various injuries, such as pressure, blow, concussion, stretching, etc., in all of which the immediate cause was continued maltreatment and septic uncleanliness of the solutions of continuity. The part played by specific deleterious substances (micrococci, Ogston) cannot be determined with certainty in the present state of our knowledge.

Individual parts of the body, viz., those which possess a loose, large-meshed connective tissue, like the neck, inguinal region, limbs, appear to be the site of severe phlegmons more frequently and upon slight provocation. Whether the sex, age, and constitution form a special predisposition cannot be readily decided. Statistics show a large majority of males of middle age and feeble constitution. But it is possible that the first two fac-

tors, like occupation, are represented by large figures merely because they afford more frequent opportunity for injuries, etc.

*Symptoms and Course.*—It is advisable to discuss the circumscribed phlegmon separately, as this must be regarded as a pattern of the non-complicated form. Before it becomes noticeable externally, the patient experiences in the affected part an annoying feeling associated with tension, which very often increases to decided pain after the lapse of twelve to twenty-four hours. About this time, a slight elevation is noticed at the part, but it is not movable and feels hard, especially towards the deeper parts. If the site is more superficial, and the layer of epidermis is not thick, a distinctly visible redness is present, which grows pale, to a slight extent, on pressure, and is lost gradually toward the periphery. If the part is kept quiet, complete resolution may occur even after the consistence has become doughy and slight fluctuation is noticeable. The redness, tension, and swelling then subside, the pain diminishes steadily, and resolution occurs, leaving behind a darker coloration of the skin. If resolution does not occur within the next two to five days, the process passes into well-marked suppuration. The patient experiences deep down a dull, hammering pain, which increases, and robs him of sleep. The swelling increases, the redness becomes more marked, and the œdema in the vicinity spreads further. If no improvement is effected, the inflammation becomes more intense, the skin becomes thinner, extremely red, and the pus is seen shining through. Not infrequently moderate fever develops. Perforation occurs commonly during the second week, when a relatively large quantity of foul-smelling pus, mixed with shreds of connective tissue, is discharged. If the further course is favorable, the walls soon become applied to the base, and the entire process terminates within one to three weeks, inasmuch as the granulations which are situated opposite one another become united. An infiltrated zone, which persists for some time, is left behind.

In deeper but circumscribed phlegmons, some time always elapses before the process reaches the surface. The patient, therefore, suffers for a week without being thoroughly conscious of his condition. In addition, the conditions differ from those previously described, inasmuch as the symptoms are graver, and its extension, as well as complications, are thus favored.

The larger the territory implicated, the more serious and grave the entire process becomes. As a rule, a chill, followed by high fever and disturbed general condition, occurs with the first evidences of a diffuse phlegmon. The patient complains of violent pains in the affected spot, which is very red and markedly swollen. When the disease occurs more superficially, the latter symptoms are more developed from the beginning, and the œdema of the vicinity has also spread largely. The skin cannot be raised in folds; it appears to be tightly stretched, and feels hot and rigidly infiltrated. Under relatively high fever, which shows only slight remissions, the pain becomes more severe and continuous, and the redness, swelling, tension, as well as the infiltration, progressively increase. If the process has reached its acme, resolution very rarely follows, but usually suppuration. In this event, the pains and fever often subside for a number of days and then return undiminished. In this stage, the skin looks dark-red to livid, grows progressively thinner, often has vesicles filled with sero-bloody contents situated upon the surface, feels very hot to the touch and allows fluctuation to be demonstrated with certainty. If perforation now occurs, or the pus is evacuated by an incision, we may convince ourselves that it has the same constitution as in circumscribed phlegmon. There are differences, however, between the morbid processes in circumscribed and diffuse phlegmons, inasmuch as in the latter the tissues immediately surrounding the

purulent focus become necrotic over a certain extent, on account of the circulatory disturbances produced by the cellular infiltration. This does not occur exclusively during the continuance of suppuration, but also for some time afterwards. As a result, considerable losses of substance arise. Other differences consist in the fact that the infiltration, which is firm to the feel, gains the upper hand toward the periphery, and, inasmuch as it resolves over quite an extent of surface, it defines at the same time the boundaries of the local extension of the inflammation. If the termination is favorable, the purulent degeneration of the tissues constantly diminishes, the fever sometimes ceases almost suddenly, the pus acquires a better appearance, and the necrotic shreds of tissue become looser and are cast off.

If this is not the case, the phlegmon extends in area and also spreads more deeply. In the former event, the condition becomes so much more grave because the joints and important organs may become implicated.

If the phlegmon extends deep into the subcutaneous connective and adipose tissue, or is beginning to do so, the general malaise and the continuous fever will announce the severity of the affection. But we only become cognizant of its entire extent when the deep throbbing pain worries the patient constantly by day and night, and when the condition of his vital forces rapidly grows worse. If the pus is not evacuated at the proper time, it will effect an exit at one or more parts of the integument. If the surface of the wound is laid bare, we will be astonished by the ravages produced by the purulent degeneration and by the wide extent of surface which has been undermined.

The course is disproportionately more complicated in subfascial phlegmons. On account of the anatomical conditions, the inflamed tissue has insufficient space to spread and is forcibly retained by the fascia, on account of which the patient experiences unspeakable pain, and strangulation and mortification from the abolition of the circulation in the tissues occur very early. If pus has formed during the further course of affection, it cannot force its way to the surface, but must make a place for itself laterally and toward the deeper parts, thus giving rise to sinuses, etc. And because this goes on at the depth referred to, the process necessitates a very long painful period until the purulent deposit is discovered. In the mean while, a phlegmonous inflammation of neighboring joints may have followed, it may have extended in the intermuscular spaces for an enormous distance and have affected the periosteum, bones, even the marrow of the bones itself. Despite this, healthy, strong individuals on the average survive this form of phlegmon quite well, if it is not too prolonged, for as soon as the pus no longer accumulates, and the pressure accordingly ceases within the cavities which have been formed (thus preventing the absorption of injurious substances at the periphery), the fever ceases, and the vital energy of the patient improves. Hand in hand with this is the rapid restoration of the extensive losses of substance, since these are very soon compensated after all kinds of putrid processes by luxuriantly sprouting vegetations.

The acute purulent œdema of Pirogoff, the gangrene foudroyant of Maisonneuve, must be regarded as the worst form of deep and diffuse phlegmons. Introduced at the onset by severe general symptoms, the inflammation appears usually in extensive contusions and unclean torn wounds, and only exceptionally arises from smaller, insignificant injuries. About the third or fourth day, we observe that the edges swell, are very sensitive, look unclean, and secrete putrid matter instead of pus. During the next twenty-four hours, the swelling may spread to such an extent that it occupies the half of one limb, and the skin acquires a dirty, brownish-red color, which grows slightly paler under the pressure of the finger. If the process is left to itself, the sero-purulent œdema

spreads more and more, while ichorous infiltration followed by gangrene appears in the parts first affected. We are not a little astonished to find emphysematous crackling and a vague swashing, instead of the expected fluctuation. If we incise the skin, there escapes a putrid mass permeated with bubbles, and in which unrecognizable shreds of tissue are contained. In the most acute cases, extensive necrosis of the tissues rarely occurs, as the patients usually die of septicæmia on the fifth or sixth day. If the process runs a less rapid course, it might be expected that the affected venous, capillary, and lymphatic vessels will gain time in the mean while to compensate the circulatory conditions and that, the secretion and necrotic shreds of tissue having been removed by a sufficient number of incisions, the process will become circumscribed; but this takes place very rarely. The phlegmon is not circumscribed commonly, despite the evacuation of the ichor accumulated in the deep parts, and all kinds of complications supervene, on account of which (especially the continued high fever) the strength very rapidly fails. The patient assumes an icteric look, has a small frequent pulse, occasional clouding of the sensorium, restless, furibund manner, and either a complicating pneumonia, a parenchymatous nephritis or the like, or the anæmia and adynamia developing out of the typhoid stage make an end of his painful existence.

*Anatomy.*—If we secure for the examination a freshly amputated limb and make sections through it in various places, we will become sensible of a resistance at the periphery of the phlegmonous process on account of the infiltration. If pressure is made with the blade of the knife upon the cut surface, a straw-yellow serous fluid, mixed with small particles, oozes out; this is poor in cells, and contains only a small number of pus-corpuscles surrounded by flakes of fibrin. If we proceed a little further towards the centre, the cut surface presents a lardaceous appearance and discharges a yellowish-white, thick, sero-purulent fluid in which float fat-drops that have been set free. The subcutaneous cellular and adipose tissue is brittle and readily torn. Beginning from this place, the gradual spread of the inflammation, the thrombosis of the vessels, the increase of the purulent foci, the degeneration and death of the tissues, etc., can be followed quite accurately to the central part. Finally, if we incise those places in which the phlegmon has effected the greatest ravages, we will find upon the walls nut-colored, loosely-hanging shreds of tissues, which tear readily on traction. If the phlegmon was subfascial, the completely exposed bone with infiltration advancing into the medullary substance is not infrequently presented to view.

Pneumonia, or pleurisy, or pericarditis, etc., and, almost without exception, parenchymatous nephritis are found in the internal organs.

Microscopical examination shows that in the beginning the connective tissue is saturated mainly with serous fluid, loosened and infiltrated with round cells, which increase during the further course of the affection; in addition there is cellular infiltration of all the tissues. In consequence of the serous and plastic infiltration, circulatory and nutritive disturbances occur and then effect the destruction of the tissues. In reality, therefore, we notice the same processes which were observed in other inflammations attended with destruction of the parts. The difference depends only on the degree of infiltration and its extension.

*Prognosis.*—Since even the simple circumscribed form of phlegmon generally produces febrile movement, and may readily pass into a more severe form, we should not undervalue it on the onset. It is, however, devoid of danger, so long as it is situated superficially and is not very extensive. In the opposite event, it becomes dangerous to life, not alone on account of the continued high fever, the formation of pus, and the

destruction of the tissues, but also on account of its extension to more important parts of the body, thrombosis, pyæmia, septicæmia.

*Diagnosis.*—Phlegmon is characterized so distinctly by the firm infiltration, the fever, great pain, and the special tendency to suppuration and destruction of the tissues, that only in progressing cases is it possible to mistake it for erysipelas. This will be prevented, however, by careful consideration of the general character of the clinical history and its further course.

*Treatment.*—The first object is the discovery of the focus of disease in order to remove as soon as possible any injurious influences which may be present. If this has been accomplished, the physician should satisfy himself of the condition of the patient, as his further treatment must vary accordingly. If the inflammation has not assumed large dimensions and suppuration has not occurred, resolution is possible. The best methods for furthering this are absolute rest and a suitable horizontal position. I would warn against the use of gray mercurial ointment, for it is still doubtful whether the ointment acts upon the inflammation as a resolvent, while it is more than probable that the skin is irritated and the occurrence of early necrosis thus aided. It should be mad- a principle that irritating measures should never be employed under any circumstances. If the pains are severe, ice may be applied, but we should never expect to prevent suppuration by this means, and it should never be applied continuously.

If the inflammation spreads and suppuration occurs, the main principle consists in making one or more extensive incisions, according to the condition, because the subjective sensations of the patient improve and even the pains notably diminish from the relief of the tension in the vicinity of the purulent focus, the emptying of the blood-vessels, and the removal of the exudation. If a free discharge has been effected and the shreds of tissue, without being much pulled upon, are removed by means of the scissors, we must keep the wound very clean. This is best done by constant, or at least very frequent washing (irrigation). For this purpose a drainage tube, fenestrated in a number of places, is pushed in as far as possible, and, being brought in connection with the tube of an irrigator, is constantly irrigated with a disinfecting fluid. It is quite immaterial whether acetate of alumina (Burow), carbolic acid, salicylic acid, chloride of lime, etc., is employed. If this plan is not practicable, the continuous bath may be used to equal advantage. If new phlegmonous deposits of pus form, the incisions must be repeated. If, despite this, no standstill occurs and the powers of the patient threaten to fail, amputation must be performed if the affection is present in a limb, without too long delay. The disease very often improves at once after such operative interference. If high fever or the typhoid stage is present, quinine in doses of 1–1.5 pro die proves very useful. When there is insomnia, we may resort to opium to produce sedation.

The low general condition is best combated by the administration of easily digested, nourishing food, wine, and also iron, bark, etc.; emetics, laxatives, etc., being entirely avoided.

## FURUNCULUS.

The diminutive furunculus was first applied by Celsus to a pointed swelling, associated with inflammation and pain, which presents a great tendency to pass into suppuration and is characterized by a deeply situated, necrotic core of cellular tissue. Even now we look upon his description as masterly and little remains for us to do beyond enlarging on details.

*Definition.*—The furuncle is an acute circumscribed inflammation of the cutis, starting from the vicinity of the follicles and glandular structures, which first leads to mortification of the originally affected tissues and later to suppuration and removal of the core.

*Symptoms and Course.*—The attention of the patient is first attracted by slight itching or burning of a slightly reddened point. If the finger is passed over it, it is felt to be a hard point which, in the course of the next twelve to twenty-four hours, becomes more extensive and develops into a nodule. This gradually becomes pointed in the middle and a pustule develops at the end of the third or fourth day, situated on a reddened, infiltrated base; it usually surrounds the opening of a follicle and is perforated by a hair. In rarer cases it continues in this acute stage for one or two days, then the redness diminishes, the infiltration disappears, the pustular contents dry, and the entire efflorescence thus becomes abortive. Usually, however, the inflammatory swelling spreads further. Then we often find, even during the next few days, a bright-red, sharply defined tumor, perhaps as large as a pigeon's egg, feeling as hard as wood or of a doughy softness in the centre, and bearing a little pustule or a yellowish-brown scab. On account of the throbbing, boring pains deep down, it robs the patient of sleep, takes away the appetite, and even produces fever. If no incision is made before the seventh or eighth day, spontaneous perforation occurs at one or more points with the discharge of a purulent and sero-blood fluid, which upon lateral pressure is followed usually by the core of tissue which has been loosened by the exudation. In its further course the walls gradually come together, granulations develop, and recovery occurs in one to two weeks. The permanent results are small irregular cicatrices which in time grow pale and become flattened almost to unrecognizability.

*Etiology.*—In a large number of cases we are in a position to demonstrate directly the cause of the affection, for we may convince ourselves that all the irritants which act upon the skin for a long time will lead to the formation of furuncles sooner or later. As one of the best known illustrations I will mention friction of the skin by articles of clothing, the tools of mechanics, etc. But the skin itself may also present the conditions by which it is kept constantly in a condition of irritation. This category includes chronic itching eruptions (eczema, prurigo, pruritus, pemphigus pruriginosus), and also those agents which first produce protracted itching and subsequently those inflammatory processes. Thus furuncles develop in consequence of scabies, pediculosis, dermatomykosis favosa, pustulosa (sycosis parasitaria), etc. Inunctions of ointments, metallic salts, solutions, tinctures (iodine), the use of plasters (empl. diachyl. comp.) must be regarded no less as causes. This class also includes those ominous furuncles which in water cures are falsely stated to be the desired signs of the crisis. They develop in all kinds of affections of the sebaceous glands and follicles (comedo, acne, sycosis vulgaris s. folliculitis barbæ), and perhaps it is for this reason that furuncles often occur in those individuals whose occupation necessitates their presence in impure, dusty air.

But the furuncle also occurs in connection with other diseases, symptomatically, and if they follow one another for a long time and extend over large surfaces of the body, we accept the view of a special diathesis and speak of furunculosis. Patients with diseases of the intestinal tract often suffer from them until the recovery of the primary affection. In diabetes mellitus and insipidus, the appearance of the furuncles sometimes precedes the presence of sugar in the urine, and even directs attention to it. In tuberculosis, scrofulosis, and other cachectic and marantic conditions, the furunculosis may continue until the end of life. However, we find it preferably making its

appearance as an avenging Nemesis where the patient has sinned much in baccho et venere.

Furuncles occur with relative frequency from the age of puberty to middle life in both sexes. This evidently is due to the constitution of the integument, the development of the glandular structures, the follicles, and the growth of the hair.

To judge from previous observations, I think I may state that individuals who have a rough skin (due to an accumulation of epidermis around the follicles), thick, dark hair and vigorous growth of hair are more predisposed to the formation of furuncles.

Furunculosis is said sometimes to develop epidemically when variola, erysipelas, and phlegmons prevail.

With the exception of the palms of the hands and soles of the feet, where furuncles are observed very rarely (Duplay), they occur in all parts of the integument. The spots of predilection are the buttocks, scalp, axillæ, back, neck, cheeks and eyelids.

*Anatomy.*—We are seldom in a position to examine in detail all the stages of the disease.

We may state with a degree of probability bordering on certainty that the inflammation arises from embolism of the capillaries around the follicles of the sebaceous and sudoriparous glands, and that, in the further course, mortification of the tissues with plastic infiltration in the vicinity occurs at the spot originally affected. If these conditions are once established, the other changes develop with a regularity peculiar to these processes. Pus makes its appearance, this loosens the detritus of tissue and, by a propagation of the inflammatory irritation, both contribute to the necrosis of the skin, the discharge of the contents, etc. The inflammation terminates spontaneously, because the pathological process is confined to a very small spot and the exudation is rapidly removed.

*Prognosis.*—The disease is absolutely mild, if uncomplicated by erysipelas or phlegmon. As Celsus had already remarked, it heals even without medical interference. The furunculosis dependent on a diathesis alone deserves more serious consideration.

*Diagnosis.*—The recognition of the disease can scarcely present any difficulties. Its circumscribed, sharply defined, rounded form, with the characteristic conical tip in the middle are unmistakable signs.

*Treatment.*—If there is any hope of abortive retrogression, ice compresses should be employed. They relieve the pain at least, and diminish the tension. If the furuncle has developed to such an extent that the consistence is already doughy, it is advisable to use poultices. The plasters, containing large quantities of resinous substances, but prepared without care, which are so warmly recommended by the laity, often produce ulcerations to an unwished-for extent. If fluctuation is present, it is best to divide the tumor, which should be done by one or more free incisions crossing one another. In this manner the necrotic connective tissue and the pus, substances which aid the continuance of the inflammation, are evacuated and the entire process conducted to its natural termination.

## CARBUNCULUS, ANTHRAX.

The views of the past and present agree in this that the carbuncle is an acute circumscribed inflammation of the cutis and the subcutaneous cellular tissue, with fibrinoplastic infiltration, and which from several points leads to mortification of the affected tissue and, by its progressing character, to an extensive gangrenous process.

*Symptoms and Course.*—If we compare the characteristics of the carbuncle with those of the furuncle, a certain agreement cannot fail to be recognized. In both instances a prominent swelling upon a reddened and infiltrated base, which has pustules on its surface, develops in the places of predilection, *i. e.*, those provided with firm connective tissue and abundant adipose tissue (neck, back). If the course of the carbuncle is very mild, the infiltration very soon becomes circumscribed and the symptoms of the disease, which have reached their full development by the end of a week, then begin to retrogress. During the course of the next week, perforation occurs, varying according to the number of pustules, and giving rise to evacuation of the connective-tissue core and the pus, on account of which the severity of the symptoms diminishes and the entire appearance thus corresponds to the action of a number of furuncles. If the carbuncle takes an unfavorable turn, it has a greater significance than a severe furuncular inflammation. This is manifested spatially by the fact that the carbuncle often grows larger than the palm of the hand and spreads further at the periphery, even if perforation has already occurred in the central parts. In this manner large infiltrated spots result, occupying, for example, the half of the back; at many points they are interrupted by yellowish or discolored necrotic projections, between which the skin has been converted into a dark to bluish-red, thin bridge.

The further local course may be truly desperate, although the termination of the disease is not necessarily bad. The infiltration may increase constantly or at least continue unchanged, the circulation in the tissues be destroyed, the œdema increase, hemorrhagic vesicles develop at the periphery, the cutis die in its entirety, the suppuration spread into the adipose tissue and cause undermining with a very penetrating odor, exceptionally even implicate the fasciæ, muscles, and periosteum, and yet a standstill occurs, followed by the casting off of the cellular tissue, luxuriantly sprouting granulations, and a somewhat protracted convalescence. The only evil which certainly remains after a carbuncle is a cicatrix corresponding to the amount of the destruction, perhaps with sequelæ secondary to the latter. Experience teaches that the danger depends not so much on its extent and its spread deep down, but rather on its quality.

Trifling carbuncles, which never attain any considerable dimensions, may run a fatal course in an extremely short period in marantic individuals and after septic infection, and *vice versa*. The long prevailing opinion that the large and deeply-seated carbuncles are dangerous, because an absorption of poisonous substances readily follows, certainly cannot be regarded as generally valid.

We still have to devote a few words to the general disturbance so frequently present in carbuncles. Fever must be regarded as one of the most essential features. At the beginning it is usually proportionate to the extent of the inflammatory process; it becomes severe and assumes the typhoid character as soon as septic blood poisoning has occurred or internal organs have become affected to any considerable degree. Its significance is so much greater because usually individuals with depressed vital forces are affected by carbuncles and a large part of the fatal cases fall victims mainly to exhaustion. Profuse suppuration, extensive gangrene, severe and constant pains, and the like may also endanger the life of the patient. As a no less important complication we must regard the extension of the process to more vital organs, by which peritonitis, pleurisy, spinal meningitis, tetanus, etc., may develop.

Among the most serious forms of the disease is the carbunculus malignus (splenic fever carbuncle), known as malignant pustule, and which occurs chiefly in the face or

other parts which are kept bare. In a number of cases we are in a position to observe the direct transmission of the poison of splenic fever, but it may also happen that there is only a suspicion of such inoculation by flies, etc., and in still others this may be excluded with certainty. In my opinion, we must not associate with carbunculus malignus an etiological conception. The affection of the skin begins commonly with a slightly infiltrated spot as large as a grain of sago, which causes no pain and may readily pass unnoticed. According to the violence of development, the epidermis, is elevated, after a few hours or within a day, in the form of a flaccid vesicle filled with sero-bloody contents, which becomes converted with equal rapidity into a brownish-red crust situated on a firm infiltration. If the course should be favorable, a standstill occurs after its extension to the size of a pfennig and the entire process then remains a local, circumscribed one. In the opposite event, the bluish-red infiltration spreads farther, the œdema becomes very considerable, the adjacent glands are markedly swollen, and the destruction progresses quite rapidly from the centre toward the periphery. The fever increases, vomiting begins, the intestinal tract becomes inflamed (intestinal mycosis), consciousness becomes more clouded, and death follows with symptoms of toxæmia (decomposition of the blood).

*Etiology.*—With the exception of those carbuncles which arise from bacilli or the specific poison of splenic fever, the same etiological factors which we have adduced with regard to furuncles and furunculosis hold good as the causes of this disease. (Tegumentary irritants continuing for a long time, and certain constitutional diseases, such as diabetes, uræmia, etc.) Even the sites of predilection are the same as in the case of furuncles. With regard to age, however, an essential difference is manifested; carbuncles occur especially in individuals of advanced age, or in those who are prematurely old.

*Anatomy.*—From the beginning to the end, the structure of the carbuncle is so similar in all essential respects to that of the furuncle, that even when different clinical symptoms become prominent, the anatomical agreement of both can be observed. We therefore refer you to that part of the chapter referring to this subject.

*Diagnosis.*—If we remember that the carbuncle is a circumscribed, tense, hard, prominent swelling situated in the subcutaneous cellular tissue, and which, if it softens, contains a number of necrotic shreds, and, if these are absent, appears perforated like a sieve, we will be saved from mistaking it for a furuncle, phlegmon, or erysipelas.

*Treatment.*—The method of treatment is indicated clearly by surgical principles. At the onset we should endeavor to relieve the tension and pain, and this may often be effected by ice compresses. If they prove insufficient, or are not tolerated by the patient, do not dread the possible hemorrhage, but make even at this stage free incisions, or apply Vienna caustic paste, and let it lie until the entire skin is converted into a dark scurf. If suppuration is present, vertical and transverse incisions, made sufficiently deep through the gangrenous swelling, constitute the best measure. By this means free escape is given to the pus, the inflammation of the parts relieved, and the absorption of poisonous substances combated by the diminution of pressure. The further treatment consists of the frequent (three to four times pro die) introduction of kali caust., camphor, Burow's solution, etc., keeping the wound clean or irrigation.

The general condition always demands the greatest consideration. We must endeavor to keep the fever down as much as possible, and to combat the loss of strength at an early stage by easily digested food and good wine.

## ECTHYMA.

Willan was the first to bring the unmeaning term ecthyma into vogue. According to Willan-Bateman, ecthyma is an eruption of large phlyzacical pustules, each situated on a deep-seated, inflamed, hard base, with a dark-brown to black crust on drying, and usually terminating with a superficial cicatrix. It is said not to be contagious, and to occur isolated over the entire body. They differentiated four varieties: E. vulgare, infantile, luridum, and cachecticum. The dermatologists who followed Willan accepted these views with rare unanimity. Alibert accepts the standpoint of Swediaur and believes that ecthyma can be replaced by phlyzacion, wherefore he includes it among the herpetiform eruptions. Hebra and Baerensprung stand upon a purely historical foundation and dispute the right of existence of ecthyma as an independent morbid genus, as it was employed originally only in the sense of exanthema and ecthylata; Kaposi associates with it merely the pathological notion of a pustule. Starting from the Willan-Bateman definition, E. Wilson classes ecthyma among the furuncular affections. Not as though it presents a clinical picture similar to this, but rather on account of its frequent association with furuncles, its pyogenic character, and the formation of cicatrices, and because both often appear to be the expression of a lowered general condition. Among German specialists, Auspitz has recently expressed himself emphatically for the retention of ecthyma, but he believes that it should be placed in the class of superficial inflammations in the family of stasis catarrhs of the skin, on account of the venous stasis of the base and its termination with a new coating of integument. Some English and French writers assume the existence of a contagious ecthyma.

We have discussed the historical development of ecthyma in order to show the changes through which it has passed, and also that its existence is not undisputed even at the present time. If we merely consider the etymological meaning of the word ecthyma, there can be no doubt that, in the absence of a special pathological conception, it cannot be used to describe a variety of disease. However, dermatological nomenclature contains a sufficient number of such inexpressive terms. But in the present instance, the dilemma is so much the greater because we are not even able to erect a uniform clinical history. A number of authors since the time of Willan have indeed placed in the foreground, as an ecthyma eruption, the pustule situated on a reddened and infiltrated base, but the views concerning details differ to such an extent that some identify ecthyma with all kinds of trivial pustular eruptions, while others state that they have observed it in the course of gangrene and severe general symptoms. But if the subject is investigated without bias, it will be found that there is a pustular eruption in the Willan-Bateman sense, which occurs sporadically as a circumscribed inflammatory nodule, is converted, after a few days, into a pustule which may attain the size of a pea, and, inasmuch as the redness or infiltration increases for some time at the borders, the top of the pustule is perforated without any definite cause, and a loss of substance is produced. Such eruptions may occur in all parts of the body, but preferably upon the limbs, usually produce no noteworthy disturbances, and must not be mistaken for the pustules of scabies, prurigo, eczema, etc., for impetigo, or the ordinary furuncle. If we wish to apply to this form of eruption the term ecthyma which is at our disposal, we would undoubtedly be guilty of a slight usurpation with regard to the name. It would be admissible, however, in case of necessity, since we neither do an injury to any affection already known, nor would we produce any confusion; this involves less contradiction,

also, than when the synonym of the French writers, furoncle atonique (Guersant) is employed.

Although we are unable to demonstrate in every case the irritant which produces such pustular eruptions, we may nevertheless say this much, that we meet with it, often in large numbers, when the integument is unclean and not well cared for, particularly in delicate, sensitive, and also in badly nourished and feeble individuals. Sex causes no difference, but age does, as it occurs more frequently in poorly nourished children and marantic old people; vigorous, youthful individuals are rarely affected by it, and even then only by a few pustules.

The eruption is of no importance from a prognostic standpoint, as it recovers without medical interference.

So long as the pustule or crusty deposit is present, it is advisable to apply emollients such as oil, fat, etc. If the loss of substance has been laid bare, we may make use of the ordinary dressings.

## ALEPPO EVIL, BISKRA BOUTON, DELHI BOIL, ETC.

The first mention of the local affection occurring in and around Aleppo is made in Pococke's (1745) report of his travels. He states that the water, which is conveyed to the city in aqueducts, has the property of producing boils (botches), and that it occurs once in the life of natives as well as foreigners, usually in the face. The first detailed description is furnished by the brothers Alexander and Patrick Russel. According to their account, the affection appears either once or several times, among the natives in the face, among foreigners on the limbs, is not contagious or hereditary, and is also not communicable by vaccination; it is not confined to Aleppo, but occurs in the entire vicinity.

It was learned, however, that a similar exanthem occurs in the valley of the Euphrates, in Egypt, upon Cyprus and the Sind, in the northern part of Arabia, in Algeria (Biskra boils), Persia, around Delhi, etc., and there extends over entire valleys and tracts of land. Willemin has therefore proposed to introduce the more general term "tubercule d'Orient" instead of the many special terms.

The drinking water has been regarded as the immediate cause of the nodules on account of the presence of magnesia (Jilt), salt (Poggioli, Weiss), alkaline and earthy salts (Massip, Netter), and organic substances (Bysson). Some assume that the gases escaping from marshy districts, and others that the climate are the producers of the germs of the disease. Flemming and Schlimmer conclude from their vaccination experiments that in the first stage of development, a substance (Distoma hæmatobium) must be present which is destroyed during the suppuration. Carter believes that the Biskra boil is a granulation tumor produced by a fungus, and that mycelium threads are found in the lymphatic vessels.

The descriptions of the disease are as manifold as the etiological factors. With the exception of the symptoms mentioned by the Russel brothers—that nodules form gradually under inflammatory symptoms, degenerate sooner or later and heal within a year, usually leaving behind disfiguring cicatrices—no description has hitherto held its own permanently. Each traveller to the Orient accuses his predecessor of inaccuracy. While Pruner places the Aleppo boil among the pustular exanthems, Rigler regards it as a furuncle. This is contradicted by Willemin who describes what, in our judgment, is a well-defined lupus. Pollak regards the "salak" occurring in Persia as a process allied to

lupus, but states that in Persia syphilis, scrofula, and the like are observed very frequently, but not lupus. Bertherand, on the other hand, regards the disease as syphilitic in its origin.

During my stay in the Orient, I became convinced that the diagnosis of Aleppo boil is applied to the most various exanthems, such as eczema, furuncle, lupus, syphilis, scrofuloderma, etc.

*Treatment.*—In general, the opinion is prevalent among the people that the boil, whatever name be applied to it, should not be treated, as its course cannot be shortened, and any interference renders the cicatrix which remains still more disfiguring. Nevertheless, we find that even Russel has recommended the "mercurial plaster" as a very effective remedy. Jilt states that sarsaparilla has proven most useful, as the affection is mainly of a scrofulous nature. A salve of pulp. cass. and butter is employed in preference by the inhabitants of Aleppo. The majority of physicians employ the most varied caustics, partly in order to hasten recovery, partly in order to obtain better cicatrices. Pruner recommends that compresses of lead water be applied at the onset and that later, during the stage of suppuration, the ulcers be strewn with powdered sulphate of copper. Pollak recommends cauterization with fuming nitric acid; Floyd advises washing with common salt; Rigler regards it as most advisable to open the boil by crossed incisions, and if, despite this, its course threatens to become prolonged, to cauterize the base of the wound a number of times with lapis infernalis.

In accordance with my views concerning the existence of the boil, I have not confined myself to a definite plan in the treatment of at least 200 bouton patients. (!) According to circumstances, *i. e.*, according to the scientific diagnosis, I have employed empl. neapolitanum, the Bruns-Volkmann curette, nitrate of silver, or even merely a simple cerate, and have obtained very satisfactory results.

## B. CHRONIC DEEP-SPREADING INFLAMMATIONS

BY

# PROF. ERNST SCHWIMMER.

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### SCLERODERMIA.

THE number of accurate observations of this disease has only increased markedly during the last two decades, and while, according to Heller's statistics, only fifty-two cases had appeared in literature ten years ago, their number now is probably nearly twice as large, since new observations are reported every year in special works, journals, etc.

*Symptomatology and Course.*—We apply the term sclerodermia (scleroderma, sclerisasis, and sclerema of the text-books) to a chronic disease which attacks individual parts of the integument or the entire surface of the skin, develops without any inflammatory process and either persists for a long time as a local disturbance or, after slowly spreading, results in a rigidity and hardness of the skin, on account of which the latter entirely loses its normal elasticity and, in its further course, suffers considerable shortening.

(*a*) *Partial sclerema, sclerème en placards.*—This occurs in individual parts of the skin and may affect the most varied surfaces of the body, usually in the form of oval or irregular, round or elongated patches, stripes of a yellowish white or wax-like color. To the examining finger they appear as an inelastic firm tissue, which can with difficulty be raised from the underlying layers into a fold. The affected surface itself is usually shining, and the healthy skin surrounding the diseased parts often appears changed by more marked pigmentation, or a rose-colored or bluish border, so that the former sometimes looks as though it were surrounded by an elevated circumference. Partial sclerema occurs in manifold forms and in recent times various local nutritive disturbances, which develop as the results of morbid innervation, are included in this category. To these local forms belongs the sclerodactylie[1] described by Ball, in which the disorder usually appears symmetrically at the ends of the limbs, on the fingers more frequently than the toes; this affection forms a transition to symmetrical asphyxia and gangrene.

Furthermore, the affection described by English physicians as morphœa localis which often occurs in the direction of individual nerve trunks. Finally, the sclerema associated with atrophy of the affected parts of the skin. Under whatever form it may appear, the changes in those parts of the integument affected by partial sclerema are important, inasmuch as the diseased skin, if it shows no tendency to restitution, becomes thinned,

[1] Société de Biologie, 1871.

parchment-like, and the atrophy of the cutis extends gradually to the underlying layers, including the muscles.

In consequence of the trophic changes produced by sclerema, the skin and its appendages will appear disturbed in various ways. Jamiesson[1] reports the case of a young man, in whom extensive patches of the kind described were present not alone upon the trunk and limbs, but the scalp also presented several sharply defined spots in which the hairs appeared as white bundles in circumscribed spots; many of the patches on the trunk ran their course along the intercostal nerves. Gibney[2] reports a case in which morphœa spots were present on the trunk and scalp, and in which unilateral facial atrophy had occurred in the course of a few years. Such cases are better evidence of the character of the affection than those which are manifested by the simple formation of spots (morphœa), as the latter may be mistaken readily for cases of vitiligo in a certain stage of the disease. Special attention must be paid, therefore, to certain phenomena connected with the color of the skin, as belonging to the diagnosis of partial sclerema. These are certain lilac discolorations with which the disease begins, and upon which special stress is laid by Wilson, Fox, and others. As in erythema iris, white, rose-colored, and lilac-colored zones can be distinguished from one another within the sclerotic patches, but these signs become lost after long continuance of the disease, and it then acquires a waxy, white hue.

(*b*) *General Sclerema.*—We apply this term not alone to those sclerema affections which attack the entire surface, but also include those forms of extensive sclerosis of the skin, in which the affection is present over a great extent, and the spread and increase of the disease occur to such a degree that the change is found over extensive surfaces.

The affection begins generally in a circumscribed portion of the skin, but only remains localized for a short time and then spreads into surrounding parts, until gradually the largest part or even the entire integument is affected. We may, therefore, include such cases in which a third of the integument is diseased under the head of general sclerema, as well as those in which a half or more appears sclerotic. The subjective sensations are described by the patients as very annoying, muscular action is impaired by the tense skin, and is painful. Thirial's statement that the skin affected in this manner is cold and upon contact reminds one of the sensation produced by a frozen cadaver is a very apt one. The skin cannot be raised in folds, is usually smooth or slightly scaly, as thin epidermis cells are sometimes loosened from the dry surface, but it is hard and rigid so that no depression or hollow can be produced upon pressure with the finger. In accordance with the nature of the process, the cutis appears hypertrophic in the first stage of the disease, and shows a moderate swelling which only continues for a short time and then changes, inasmuch as all layers of the skin, in addition to the muscles and fasciæ, gradually atrophy—a circumstance which gives rise to the loss of elasticity of the skin and deficiency of mobility. In sclerosis of the integument of the face, the mouth is moved with difficulty, the eyelids can scarcely be closed, the physiognomy assumes the appearance of paralysis of the face. If the sclerosis extends to the region of the neck and throat, rotation of the head can only occur to a certain extent; if the skin of the thorax or abdomen is sclerotic, respiration is impeded occasionally, and likewise the function of the abdominal muscles; finally, if the limbs are affected, their mobility becomes impaired. The fingers are in a position of semi-flexion, the use of the arms and hands is

[1] Edinburgh Med. Journ., 1880, p. 648.

[2] "On the Histology and Pathology of Morphœa," Arch. of Dermatol., 1879, p. 54.

interfered with considerably, the toes are bent, as neither complete extension nor flexion is possible, and the gait becomes uncertain and tottering. The impression created by such a patient is extremely distressing, inasmuch as the skin is everywhere shortened and tense, and literally becomes "too tight."

The functional activities of the skin are changed in a similar manner. Tactile sensation suffers no diminution so long as the disorder exists to a slight degree, but in extensive sclerema there are marked changes, and in some cases I have detected a diminution of sensation demonstrable by the æsthesiometer. The temperature sinks in some cases, and the secretion of sweat is diminished. The function of the mucous membranes is also interfered with by the tegumentary change if the sclerema occurs in their vicinity (mouth, nose, vagina).

The peculiar condition of the sclerosed skin does not prevent its affection in other ways, and the occurrence of acne efflorescences, variola eruptions, herpes, etc., may be observed in these patients. In one case of marked sclerema I saw an extensive erysipelas of the face run its course twice without any effect on the primary disease.

After a time, the color of the skin undergoes a notable change; it grows darker and brownish. In a case described by me a number of years ago, the skin had a bronze-colored appearance almost everywhere. Some patients enjoy a tolerable condition of health; in others we observe complications with diseases of the lungs, heart, and kidneys, which lead finally to a fatal termination by amyloid degeneration.

The course of sclerema is always very slow and tedious, and as soon as it has reached a certain stage of development, it undergoes either a retrogression to the normal or leads to a terminal change with an unfavorable ending. The first termination of sclerema rarely occurs spontaneously, and cases which have been recognized early and have been treated for a sufficient length of time must be regarded as the favorable forms of this affection. In such cases, the skin usually recovers slowly its lost suppleness and mobility, the hardness and board-like stiffness diminish after a while; the patients, during its further course, state with satisfaction that the tension gives place to greater mobility; the discoloration improves, and the dark color begins to disappear. It rarely happens, however, that the skin acquires the same material structure which it had previous to the disease.

The ordinary termination of sclerema, however, is that which we have just described in the symptomatology. The hard, tense, firm skin becomes continually thinner with an increase in the symptoms of tension, it feels like parchment, and, on account of the disappearance of the underlying adipose and muscular tissues, seems to be adherent to the bones; the circulation suffers considerable disturbance, and local conditions of stasis (asphyxia) occur which lead to mortification of the tissues with subsequent ulceration. The joints are fixed by the immovable skin, the patients are impeded in their manipulations, and as the vegetative functions also suffer severe disturbance, a fatal termination, which only occurs, however, after a number of years, is unavoidable. The amyloid degeneration of the parenchymatous organs is attributable to the numerous disturbances of nutrition by the impeded circulation, but the influence of the morbid innervation, which is the probable starting-point of the disease, must not be left out of consideration.

The form of this disease, described by Wernicke as atrophic or cicatrizing sclerema, should, therefore, be regarded as the final stage of the scleromatous process rather than a variety.

*Anatomy.*—The cutis appears broadened and thickened by numerous new-formed connective-tissue elements. The elastic fibres within it have increased in places, newly

formed cells, in firm, thick streaks, are seen extending through the entire skin and the muscular layers, often extending to the fasciæ ; the adipose tissue is pushed away, the smooth muscular fibres are hypertrophic. In places the papillary body is not changed essentially, though surrounded by abundant pigment granules, but smaller in places and rendered dense by bands of connective tissue. In some places the vessels are narrowed, and in a case examined by Dr. Babes and myself the tunica media and intima were considerably thickened ; the sebaceous and sweat glands are unchanged in the beginning, but they atrophy and disappear at a later period. Kaposi[1] has noticed the presence of abundant lymphoid cells which surround the vessels in dense layers like a sheath, and, in his opinion, give rise to their narrowing. According to this statement, the thickening and stasis of the lymph were relied upon to explain the subsequent rigid infiltration of the cutis with development of new-formed connective-tissue elements. Based upon these circumstances, Kaposi and Hebra[2] have expressed the hypothesis that sclerodermia occurs from a general accumulation of lymph in the cutaneous tissues, without demonstrable implication of the larger blood-vessels. In addition to the remarks which have been made above, this assumption is based on the appearances in a case which terminated fatally and was published several years ago by Heller.[3] This writer has carefully studied, not only the skin, but also the other organs and found that the lymphatic vessels were enlarged and dilated in various organs (small intestines, heart, omentum), that all lymphatic glands and the spleen were considerably harder and swollen by lymphoid cells, and that the new-formed connective-tissue-like cells which were present in all the organs, even in the muscles, showed a direct connection with the lymphatic vessels. The statement that the thoracic duct and its roots were obliterated appeared to be decisive in its significance. On account of this pathological change, a stasis of lymph was said to be produced in the connective-tissue layers of the general integument, with the sequelæ mentioned above. In how far these pathological conditions influence the occurrence of sclerema will be investigated in the following section.

*Etiology.*—Local and general sclerema have been found to develop in young as well as old people, but individuals under twenty-five to thirty years of age do not appear to be affected by this disease; it occurs mainly during middle age. There is a greater predisposition of the female sex to sclerema, but we know of no definite factor which is capable of explaining this circumstance.

The brown color of the skin has occasionally been attributed, like Addison's disease, to a change in the supra-renal capsules, but no proof of this theory could be advanced. A step was then taken from the more remote to the more immediate causes, and either the œdema or the erysipelas were regarded as the local processes which served as the prodromata of the sclerema. Virchow,[4] who mentions sclerema cursorily under the head of elephantiasis, and who regarded the long-continued œdema, which we see followed occasionally by sclerema, as the probable predisposing cause of the affection, first expressed this view, in the same manner as Rasmussen,[5] who regarded the proliferation of lymphoid cells around the blood-vessels as the first stage of sclerema, and attempted to bring elephantiasis in close relationship with this dermatonosis. Although

[1] "Pathologie und Therapie der Hautkrankheiten," Wien, 1883, S. 557.
[2] "Jahrbuch der Hautkrankheiten," Stuttgart, 1876, II., S. 87.
[3] Deutsches Archiv f. klin. Medic., 1872, S. 155.
[4] "Die krankhaften Geschwülste," Bd. I., S. 302.
[5] Journal of Cutan. Medic., London, 1871, p. 291.

it cannot be denied that a change in the lymphatic vessels does occur, and that it leads to extensive proliferation of lymphoid cells, this signifies nothing with regard to the nature and cause of the disease. In three cases under my observation, the thoracic duct was entirely unchanged, and the increase of lymph in the subcutaneous tissue could not be explained in this manner.

An affection of the nervous system explains most readily the sum of nutritive disturbances which occur in this affection. In my treatise,[1] I have directly applied the term trophoneurosis to sclerema, and have endeavored to adduce those arguments which may serve to aid this view. Among these we include, not alone the clinical history, but also some anatomical appearances recently discovered which point towards marked changes in the sympathetic, as well as abnormalities in the central nervous system. I will here mention briefly the observations of Harley, who observed marked disturbances of the action of the heart and stomach, in addition to great atrophy of the skin in an advanced case of sclerema, and who attributes all the symptoms to a paralysis of the sympathetic; furthermore, the observations of Westphal, who found pathological changes in the brain, and my own, which showed disease of the peripheral nerves; finally, the recent case of Eulenberg, who found progressive facial atrophy co-existing with scleroderma. The number of autopsies and clinical observations is still too small to determine with absolute certainty the pathogenesis of sclerodermia, but this is no less true of other constitutional affections. In the present condition of affairs, the trophoneurotic nature of sclerema may be inferred rather than demonstrated.

*Diagnosis.*—The diagnosis of the disease in any case will meet with no difficulty. It could only be mistaken for other diseases if the essential symptoms of sclerema are left out of view; for neither œdema nor the hypertrophy developing after local inflammations present the appearance of the rigid, immovable integument, nor do they show its tension, rigidity, or peculiar shortening. Local sclerema can be differentiated no less readily from the healthy parts of the skin: the shining, tense, waxy patches surrounded by a slightly hyperæmic zone, the slow development and persistence of the affection are found in no other disease. In the later stages, when atrophy occurs, consideration must be paid to the previous hypertrophic stage, in order to explain better the existing abnormality.

*Prognosis; Treatment.*—In general, sclerodermia does not admit of a favorable prognosis, but it generally leads to a fatal termination only after complication with diseases of internal organs. If the latter do not develop during the course of the skin disease, continued emaciation and marantic conditions occur. Sclerema may undergo retrogression if it has not reached its acme; the newly-formed connective-tissue elements in the cutis then undergo transformation and are absorbed. Such a curative process rarely occurs spontaneously, but by the aid of the appropriate remedies which stimulate the process of absorption and are capable of rendering the rigid skin flexible. This holds true only of those cases in which the mode of life and the constitution of the patient further the proper treatment.

The most varied remedies have been employed, and a certain effect has been attributed to one or the other method. The curative agencies employed consist of ointments of iodine and mercury, baths of all kinds (salt, iron, soda, vapor, and sea baths), hydropathic cures, external use of oily and fatty substances, such as cod-liver oil, glycerin, vaselin, tar oils, either pure or combined with alcohol. Iron, quinine, bitter tonics, etc.,

[1] "Die neuropath. Dermatonos." Wien, 1883.

were employed internally, and finally electricity, in the form of the constant current, was recommended. Of none of these remedies and curative measures can it be said that sclerodermia will positively retrogress under its use; but all, with the exception of iodine and mercurials, have a certain value. According to my experience, the constant current is one of the most valuable remedies in the treatment of sclerema, and we may recommend the exclusive galvanization of the sympathetic, though this does not prevent the simultaneous use of baths and, internally, of tonics, according to the necessities of the case.

## SCLEREMA NEONATORUM.

Hardening of the skin of the new-born must be regarded as an entirely independent affection, occurring during the first days of life, and probably developing during fœtal existence.

*Symptomatology.*—The first symptoms appear between the third and sixth days after birth, when we find that the integument over a considerable part of the lower limbs is shining, tense, of a white or rosy-red color, occasionally dirty-brown or yellowish; it is puffy, in places leaves a depression after pressure with the finger, becomes hard throughout, and cannot be raised in folds. Beginning in the calves, the disease soon spreads to the thighs, extends over the abdomen, trunk, and upper limbs, affects the neck, throat, and face, and in a short time, often within a few hours, or in one to two days, the disease has affected almost the entire body. The rapid fall of the temperature of the body, the coldness of the affected parts, and feebleness of all the passive functions of the organism point to a serious general condition. The mobility is very restricted, the children lie feeble and rigid, with the eyes usually closed, appear to be sunk in a lethargic sleep, refuse nourishment, partly on account of the stupor, partly on account of the difficulty of suckling. The action of the heart is irregular, the pulse very frequent, occasionally intermittent, not always perceptible. The respiration is also affected by the general condition; it is irregular, superficial, now and then stertorous rattling is noticed, occasionally a low, painful cry is heard. The evacuations from the bowels and the excretion of urine are diminished. The fatal termination occurs in four to ten days, under constant increase of the symptoms described.

Such a grave clinical history scarcely permits a thought of recovery, and, although we might suppose that all new-born affected by hardening of the subcutaneous cellular tissue are doomed inevitably to death, some specialists in diseases of children have seen recovery ensue when the disease had affected only individual parts of the body.

The cause of this affection appears to lie in an extensive implication of the blood-vessels. Some authors regard atelectasis of the lungs, others a congenital affection of the heart, and still others a constitutional anomaly as the most probable starting-point of the disease. These views are opposed, however, by the experience that unfavorable hygienic conditions, lack of a healthy dwelling, good air, attentive nursing, etc., most readily produce this disease. On this account, sclerœdema of the new-born is observed chiefly among the poorer classes and in foundling asylums.

Anatomical examination enables us to follow distinctly the deeply-spreading change of all the layers of tissue of the general integument. The wide-spread infiltration of the subcutaneous tissue permits it to be readily raised, in places, from the deeper layers of muscles and the fasciæ; and, upon section, we notice the exudation of a yellowish-white serous fluid, consisting chiefly of drops of fat. The internal organs are also considerably changed. While the lungs and kidneys are congested, the brain and

serous membranes appear infiltrated with moisture; the complicating diseases which occur in the internal organs are often not completely developed.

Treatment can only lead to a favorable result when the threatening accidents are recognized early. Children who are born feeble and delicate require careful nursing and attention. If the first signs of œdema or the asbestos-like whiteness and striking hardness of the limbs develop, apply softening poultices and irritating inunctions, aid nutrition by the administration of mother's milk or a good substitute, give a mild wine mixed with sugar several times a day, and endeavor to diminish the circulatory disturbances by internal and external stimulants. The stases can be relieved occasionally in this way, and the threatening accidents avoided. If a remission of the severe symptoms has once occurred, there is hope of improvement; the congenital weakness of vitality will finally give place to greater vigor, and the life of the patient thus restored.

## ELEPHANTIASIS ARABUM S. PACHYDERMIA.

*Symptomatology.*—Under the term elephantiasis arabum is meant a disease of the layers of the skin and the subcutaneous connective tissue in individual parts of the body, running a chronic course, beginning with inflammation of the blood-vessels and lymphatics, and often leading to œdema and erysipelas; it is followed by an enormous, deforming increase of tissue.

The disease affects mainly the lower limbs and the integument of the genital apparatus, and two forms of elephantiasis, characterized by their localization, have been recognized accordingly, viz., Elephantiasis cruris, and E. genitalium.

Elephantiasis in other parts of the body was described partly as neoplastic formations, partly as telangiectatic elephantiasis if the swelling presented a great abundance of vessels. Such tumors were observed on the upper limbs, face, conchæ of the ear, and in this form they constitute monstrous appendages which hang down and produce traction of the adjacent parts of the skin. Rokitansky has described the vascular structures as tumors consisting of numerous lobes, and held together by dense fibrous tissue, and the contents of which consist of ducts containing blood, and terminating in blind extremities. Kaposi and Hebra (" Hautkrankheiten, Bd. II., S. 114) described cases of elephantiatic tumors, distinguished by their abundant development of vessels, occurring upon the arms, and which may be regarded also as varieties of vascular tumors (tumores cavernosi).

In elephantiasis cruris, the origin and development of the affection are preceded by a morbid change characterized by the ordinary signs of erysipelas, and which is often combined with inflammation of the veins. The skin becomes inflamed, painful, shows the streaked redness of the affected lymphatic vessels or venous apparatus, and the neighboring lymphatic glands become thickened, swollen, and extremely painful. After the termination of the erysipelas, which is accompanied usually by violent fever, a slight œdematous swelling occasionally remains behind. The skin is slightly tense, shining, and the underlying connective tissue appears somewhat more consistent. In some cases the erysipelas runs its course without any sequelæ, and the diseased parts present merely a slight desquamation or change in the tissues. In the majority of cases, however, the œdema mentioned continues for some time, and if the skin is affected by erysipelas again or several times in succession, a tendency to persistent swelling of the lymphatic apparatus with increase of the œdema is thus produced. With the frequent recurrence of the erysipelas, either spontaneously, or after external provocation the œdema becomes permanent, the skin presents a slight depression on pressure, but as the subcutaneous tissue

is more resistant than in œdema which has developed without severe and frequent erysipelas, in places the yielding character of the integument is entirely absent, and it is hard and stiff. These conditions are also favored by the stasis of lymph in the vessels from the occlusion of the glands, on account of which the dilated lumina of the vessels become stringy and hard, and form a uniform mass with the infiltrated connective tissue. The increase in volume of the diseased parts constantly becomes more striking, and thus develops gradually that enlargement which causes the monstrous appearance of elephantiasis. The symptoms of elephantiasis have been found to develop within one or more years. The external form of the new-formed masses of tissue varies according to the parts affected. Elephantiasis of the lower limbs thus appears entirely different from that of the genital apparatus. The swelling and thickening of the affected limbs become shapeless, the contours of the muscles disappear, and the heavy shapeless extremity reminds one of the enormous dimensions of the leg of a rhinocerus or elephant, whence also the name elephantopus. The circumference of the limbs is not uniform. In a case of M'Call Anderson,[1] the circumference of the foot was about 62 cm., that of the calf 80 cm., and that of the thigh 69 cm.: in Bryant's[2] case the calf and thigh were 72 and 84 cm. in circumference. Still greater dimensions are observed in elephantiasis of the genital apparatus. Clot-Bey[3] extirpated a tumor of the scrotum of this character which weighed 110 pounds. No less great dimensions are reported when the elephantiasis occurred in unusual localities. Thus in a case of Gussenbauer's[4] of elephantiasis nasi in a boy æt. 14 years, the nose was 8.2 cm. long from the glabella to the tip, and 6.3 cm. broad.

The changes in the surface of the integument are manifold; it is either smooth, tense, and shining, or studded with numerous nodules, prominences, or circumscribed tumors which must be regarded as papillary proliferations and secondary formations, since all layers of the tegumentary tissue take part in the morbid process. But apart from the more marked changes of tissue and the new-formations on the surface of the skin, various morbid processes, such as eczema, papular efflorescences or ulcerations, are found upon it. The latter assume commonly an unfavorable appearance, develop slowly from the surface, but soon extend more deeply, destroy the fasciæ and muscles, and erode the osseous tissues. The edges of the ulcers are elevated, swollen, and form a crater-like wall around the deeply-spreading loss of substance. They must not be regarded as identical with those losses of substance which are observed in long-continued and neglected ulcers of the foot, which often result in thickening and enlargement of the adjacent parts of the skin and are usually regarded as an elephantiatic affection. In places where the epidermis is unchanged, it is dry, rough, covered with thick lamellæ which are arranged in layers, next to and above one another, in a grayish-brown or dirty-gray mass, as in ichthyosis. In some places, however, the skin usually bursts, or even the lymphatic vessels are opened, on account of the severe stasis, and an escape of a clear, milky fluid thus occurs (lymphorrhœa or lymphorrhagia).

The changes occurring in the deeper layers are still more worthy of note.

The thickening and extraordinary enlargement of the affected parts depends on the increase of the connective-tissue elements in the subcutaneous stratum, as well as in the cutis itself. According to Virchow,[5] accordingly, elephantiasis constitutes a diffuse con-

[1] Journ. of Cut. Medicine, 1869, vol. i., p. 182 and 191.

[2] Ibid.

[3] Alibert's Vorlesung u. s. w., Bd. ii., S. 216.

[4] Prager Medic Wochenschrift, 1880, No. 21.

[5] "Die krankhaften Geschwülste," Bd. i., S. 311.

nective-tissue tumor and belongs to the class of fibromata. The new-formed connective-tissue elements are present in such masses that they form a dense, firm callosity which increases still more in consistence and size, on account of a partial transformation of the other tissues, such as muscles, vessels, and nerves, into connective-tissue masses.

On the other hand, it should not be forgotten that the fibromata never develop as the result of conditions of stasis, and that they cannot be regarded as the result of transudations or real inflammation of the vessels. At the most, we may concede the analogy for those cases in which, in addition to the fibroma, circumscribed elephantiatic new-formations develop, such as are observed occasionally in some of the joints of the toes or fingers, the breast, etc.

The function of the affected part of the body is thus impaired to a considerable extent, and often abolished. Patients who suffer from elephantiasis of the lower limbs are often hindered in walking, or drag themselves along with difficulty. Occasionally, these unfortunates are confined to bed and present a picture of wretched misery.

Elephantiasis of the genitals in men almost always starts from the scrotal integument; in women, from the labia and clitoris. In some cases, the disease appears first upon the penis; in others, upon the scrotum. Elephantiasis of these parts often attains a very considerable size, but the larger tumors occur on the female genitalia (labia majora) and, being circumscribed tumors, often form the subject of operative treatment. Reyer[1] has published a large number of observations, collected in Egypt, of individuals suffering from E. genitalium, in which the tumors weighed forty to fifty pounds, and the patients had been affected with this disease for twenty years and upwards. Reyer adds the statement that the impossibility of satisfying the sexual desire causes perhaps the greatest suffering to the Arabians. In these tumors, which extend almost to the knees and ankles, a small, navel-like depression is usually visible in the upper third of the tumor; this presents itself to the examining finger as a narrow furrow, and leads either to the glans penis or the entrance to the vagina. In other respects, however, elephantiasis of the genitals does not affect the general health of the patient to any extent, and Alibert[2] reports as a curiosity that the above-mentioned patient, who was operated upon by Clot-Bey, and whose elephantiatic scrotum, when removed, weighed one hundred and ten pounds, produced two children after the disease had lasted thirteen years, but before it had attained its monstrous development—a proof that the functions of the testicles had not been destroyed by the morbid process.

The other subjective symptoms are the same, at the onset of the disease, as in erysipelatoid and lymphatic inflammations of the skin. In addition to general febrile disturbance, the patients suffer from tension, drawing, and pains in the affected parts of the skin—symptoms which disappear gradually after the formation of the tumor has assumed the upper hand, and are then followed by the above-mentioned annoying conditions of increase of weight and formation of the tumor.

The inguinal glands are always swollen and enlarged, and occasionally form small tumors in the groins,[3] which sometimes permit the escape of lymph.

In addition to the localities mentioned, elephantiatic formations also occur in other parts of the body, such as the upper limbs and the integument of the face, but these ex-

[1] Zeitschrift der Gesellschaft der Aerzte. "Ueber Elephantiasis der Geschlechtstheile." Wien, 1855. Nos. 10, 11 und 12.

[2] In loc. cit., S. 217.

[3] Hendy: "Die Drüsenkrankheiten von Barbados." From the English. 1788.

cessive hypertrophies of the skin and the connective-tissue layers are rarely the results of disease of the vessels, but rather of other neoplastic formations, such as syphilis, lupus, etc.

With regard to the age of the affected individuals, almost all statements are agreed that it develops between the twentieth and fortieth years, and that it is very rarely found outside of this period. I have under observation a patient, a boy of twelve, who suffered from severe prurigo, and in whom an elephantiasis of the left foot, extending half-way up the leg, developed within three years. The increase of volume is very considerable, and the circumference of the ankle-joint measures 40 cm.

The opinion that this disease is observed exclusively in the orient has long been refuted, and elephantiasis may be regarded as a disease extending over the entire surface of the earth. However, there are certain geographical latitudes in which it occurs with great frequency, viz., India, Africa, and some districts situated in the tropics. In some parts of India it has been observed in such numbers that, in 1857, according to an English writer, among 48,600 inhabitants, 2,133 individuals were affected by it.[1] In Africa it occurs in much smaller numbers, mainly in Egypt, Tunis, and Barbary.

*Anatomy.*—Rayer[2] gave an admirable description of the changes in the integument. He regards the enormous proliferation of tissue as the most important change, and first emphasized the fact that the fibrillæ of connective tissue appear in a number of layers placed above one another. As another striking feature, he regards the serous fluid abundantly present in this tissue, and which can be removed readily upon pressure with the finger, as well as the profusely embedded fat-cells. In addition, the papillæ appeared considerably enlarged, the epidermis thickened and discolored. These appearances were also observed by Henle, Simon, Lebert, and others. Virchow[3] devoted close study to the microscopical anatomy of the skin, and thus shed the most light on the peculiarities of this morbid process. Upon section from the surface to the bones, the skin often shows a hard, fibrous callosity of waxy consistence in which scarcely anything but fat and muscular substance can be distinguished. After prolonged duration of the disease, the nervous substance is also destroyed, and where it can no longer be found distinctly in the dead body, anæsthetic and paralytic conditions were present during life. The clear yellowish fluid which appears in abundance on the cut surface of the skin is nothing more than lymph which coagulates in the external air. Virchow explains this accumulation of lymph by the fact that in elephantiasis the glands swell at an early period, and thus impair the functional activity of the lymphatic vessels. On account of the stasis of lymph within the vessels, these become dilated and thus give rise to the abundant presence of this whitish-yellow fluid which had already seemed characteristic to Rayer. This primary affection of the lymphatic glands thus constitutes an important differential characteristic from other œdematous and erysipelatoid inflammatory conditions. The epidermis presents a variable condition, occasionally is very thin, in other cases considerably thickened. When the papilla is not distinct, the epidermis thin and smooth, when it is strongly developed and branched, it will be covered by the epidermis in thicker layers, and following the elevations, produce the previously mentioned ichthyotic appearance. The Malpighian layer often shows considerable increase of pigment, and the capillaries are dilated in places. In some cases the lymphatics are entirely

[1] Hirsch: "Histor. Geograph. Pathologie," Bd. ii., S. 477.

[2] "Maladies de la Peau."

[3] "Krankhafte Geschwülste," BJ. I., S. 300 et seq.

intact, but then the veins are markedly dilated, with distinct hyperplasia of the tunica adventitia.

*Etiology.*—The causes of elephantiasis were sought in climatic and telluric influences by many observers who saw it frequently in tropical countries. English physicians particularly regarded the moisture in the air as an especial morbid factor, inasmuch as some individuals, especially from the poorer classes, being exposed to frequent colds during the rainy season, are more readily predisposed to inflammations of the tegumentary and vascular apparatus. In addition, the constitution of the soil, the ingestion of certain articles of food, drinking water, hereditary tendency, and various other general or occasional causes were regarded as factors giving rise to elephantiasis.

Such vague statements can only be supported by the circumstance that elephantiasis appears more frequently in tropical countries; but investigation furnished a definite morbid factor, which is certainly not without pathogenetic significance, in a series of similar diseases, viz., the occurrence of Filaria sanguinis in the blood and lymph. Lewis[1] has carefully studied the pathological conditions produced by filaria and its embryos, and has shown that in the blood and lymph capillaries they may adhere in greater numbers in places to the vascular walls, there give rise to disturbances which lead to stasis and embolism, and afterwards produce tumors of the lymphatic vessels and veins with subsequent elephantiasis. Numerous physicians in Brazil, Australia, and India regard this action of the filaria in producing elephantiasis as undoubted, and we must grant the validity of this factor in the tropical form of elephantiasis.

But there are other factors which may be regarded as exciting causes and which explain the development of elephantiasis in almost all parts of the inhabited globe.

Among these may be included all those morbid factors which produce inflammations of the lymphatic apparatus and the vessels of the skin. One of the most frequent causes is erysipelas which always precedes the outbreak of the disease. Chronic ulcers of the leg, continued eczema of the extremities also give rise to these hyperplastic conditions; furthermore, dilatation of the vessels, varices, thromboses, and obliterations in parts of the vessels situated higher up, and circulatory disorders of various kinds may produce disease in a like manner. Lupus and syphilis also cause persistent thickenings of the skin, by means of which it may acquire an elephantiatic appearance.

The same causal factors hold good for elephantiasis of the scrotum: its great vascularity and the numerous lymphatics readily permit the development of this affection.

*Prognosis and Treatment.*—Elephantiasis arabum is always an extremely annoying affection, and in some cases even leads to a fatal termination. The inconveniences experienced from dragging about a foreign weight, the difficulty in the use of the affected parts, in themselves produce persistent bodily disturbances in addition to general depression and melancholia. Circulatory disturbance, formation of thrombi, and inflammatory conditions of various kinds develop. In a few cases, Hebra observed pyæmia with a fatal termination from the spread of inflammations of the veins, but such terminations do not occur often, and in the majority of cases, the organism usually accommodates itself to the changed conditions, as the disease always progresses very slowly. The patients enjoy a longer lease of life than we often would be led to expect from the morbid conditions. According to Hendy, cases of spontaneous recovery also occur, but this is only possible in the earliest stages of the disease.

Treatment is tried in various ways, partly by combating the development of the

[1] "On the Pathological Significance of Nematodes Hematozoa," 1874. Annals of Derm., 1881.

elephantiasis, partly by amelioration of the existing conditions. In elephantiasis of the legs we may endeavor to secure recovery without operative measures, which can never be effected in elephantiasis of the genitals. If erysipelas is present, it is treated in the well-known manner by rest, cold applications, and antiphlogistic remedies, and if its entire recovery is effected, one factor at all events is removed which inaugurates the development of elephantiasis. Often, however, no retrogression of the existing erysipelas or the persistent œdema can be produced despite the most appropriate treatment, and more elaborate treatment must be undertaken.

The older physicians employed local abstraction of blood, mainly by opening the saphenous or femoral veins, but the results were insufficient, and this plan has been abandoned. Frequent scarifications would be more in accordance with the object to be attained, as they may give rise to partial absorption of the œdema in circumscribed parts of the skin. But even this method of treatment has been attended with very slight success.

Partial retrogression of the elephantiatic process may be secured by methodical compression of the skin by roller bandages of linen, flannel, and rubber, which are changed frequently; their constant pressure may result in increased activity of the lymphatics with subsequent absorption of the lymph. In this plan of treatment, rest for the affected leg is always necessary, and the patients must endeavor to avoid excessive filling of the extremity with blood by keeping to bed and horizontal position of the foot. The bandages may be associated alternately with the use of emollients, such as iodine and mercurial ointments, exceptionally by the employment of full baths and vapor baths —a plan of treatment which, if continued persistently for a number of months, renders possible the absorption of infiltration which has reached an inch in thickness.

If secondary morbid conditions, such as eczema, ulcers, proliferation, etc., are also present, these must first be cured or improved, in order to combat the primary affection more readily. A compressing bandage, which must extend from the tips of the toes to beyond the limits of the thickened leg, undoubtedly results in a diminution of the volume dependent on the œdema, but it rarely reduces a long-standing increase of tissue to the normal and as these methods of treatment fail in a certain stage of the disease, many physicians have decided upon amputation of the diseased limb. But this operative measure is not always followed by the desired result. In amputation of the lower limbs, many of the patients died, and even in individuals who survived, the elephantiasis again appeared in other places. The best success was obtained from the operation for scrotal elephantiasis, which was carried out with brilliant results by the French and German physicians in Egypt.

Some time ago, another form of operative interference for elephantiasis of the leg was proposed by American physicians and practised with the best results. In 1851, Carnochan,[1] of New York, had effected complete recovery in a case of advanced elephantiasis cruris by ligature of the external iliac artery. Others have repeated this operation for the purpose of restricting the supply of nutritive material, and subsequently obliterating a certain tract of the vascular system in the tissues supplied by it. A few of the patients died of pyæmia, but the majority obtained a useful limb. Among 15 cases Erickson found 7 cases of recovery and 3 of improvement reported, and Leonard,[2] who had a favorable case, has found from the statistics collected in literature that among 69 cases

[1] Journ. of Cut. Med., Vol. i., p. 188.
[2] British Med. Journ., 1879, Vol. i., p. 934

of ligature of the artery, recovery occurred 40 times and improvement 13 times, while the condition remained unchanged in 16 cases. Some physicians, however, starting from the idea that elephantiasis is produced in the main by nutritive disturbances, have decided upon attacking the sciatic nerve instead of ligaturing the femoral artery. Morton[1] reports a case of this kind, in which, after ligature of the iliac artery had been useless in an elephantiasis of the right lower limb lasting fourteen years, a retrogression of the disease ensued within six weeks after the excision of a portion of the sciatic nerve, and the limb diminished to half the previous volume. A communication has been made very recently, which emphasizes the favorable action of the constant current in the treatment of elephantiasis. Drs. Moncorvo and Silva Aranjo, of Rio Janeiro,[2] have treated cases of elephantiasis for a long time with a strength of current of six to sixty elements, and have aided the liquefaction of the masses of tissue by occasional applications of the induced current. The treatment was attended with remarkable success, but extended occasionally over one to two years.

[1] Arch. of Dermat., 1880, p. 299.

[2] Journal de Thérapeutique, 10 Janvier, 1882.

# ANOMALIES OF THE EPIDERMIS.

PART I.

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## ICHTHYOSIS.

ICHTHYOSIS is due to a congenital predisposition of the skin to develop epidermis in excess, and according as the skin as a whole is affected over a larger or smaller area, or only the epithelial lining of the follicles, it is known as ichthyosis diffusa and ichthyosis follicularis.

In some cases, the tendency to excessive epidermal formation manifests itself at a comparatively early period of intra-uterine life, and the disease then assumes appearances quite at variance with those ordinarily met with. This last group is called ichthyosis congenita.

Ichthyosis diffusa is by far the commonest form. The so-called varieties of ichthyosis diffusa are only the various stages and degrees of intensity of the same malady.

When the disease manifests itself most mildly, only the normal furrows and rugæ of the skin are somewhat more than ordinarily developed. The epidermis is somewhat thickened, but scaly formations are absent, although the normal desquamation is slightly increased. The skin has a wrinkled appearance, feels brittle and harsh and dry (xeroderma and dry skin of English writers). Hardened masses of the epithelium now developing in excess, the epidermal layer loses its integrity, and scales are formed. The furrows between the larger and smaller scales correspond exactly with the normal furrows of the skin.

As extensive areas of the skin are affected, and these look like the skin of a fish or a snake, this variety has led to the use of the term ichthyosis (ichthyosis serpentina or cyprina). When not developed in abundance, the color of the scales is a bright, pearly whiteness (I. nitida, nacrée, Alibert). When more abundant, their color is always darker, assuming a greenish-blackish hue. As the skin affected is also darker, and gran-

ular pigment is often seen in the scales, there can be no doubt that this discoloration is caused by an extra development of pigment. The scales adhere quite firmly, especially at the centre, but can usually be removed without giving rise to any bleeding, *i. e.*, without injuring the papillæ.

In its severest forms, irregularly shaped hillocks of scales are developed, separated by deep furrows from one another, which even here correspond to the normal furrows of the cuticle. As in health, these furrows are most marked about the joints. Passage of the hand over the surface or the movements of the patient produces a noise by the rubbing of the hillocks against one another, and this has been compared to the rattle of the rattlesnake. As extreme pigmentation of the skin occurs in severe cases, the scales present a dark-green to almost black color. Large masses of scales are thrown off, and are found in the patient's bed and clothes (ichthyosis cornea or hystrix, or hystricismus).

*Localization.*—Ichthyosis presents a very marked preference for certain parts of the body, particularly the extensor aspects of the limbs and, in them, the corresponding aspects of the joints. In the slight grades, the first formation of scales occurs upon the extensor aspect of the knee and elbow joints. The disease may extend over the whole surface of the body, but then the affection is most pronounced in the regions just named. Some places remain more or less unaffected, and these are to a less extent the flexures generally, but especially the soles of the feet and the palms of the hands, the genitals and the face. However, Schmidt[1] reported a case in which the entire surface was affected, with the exception of the face and upper region of the chest. The face is the only region of the body that has not been seen to be affected with ichthyosis diffusa. Is is quite peculiar that even in the severest forms of ichthyosis the line of demarcation between healthy and diseased skin is abrupt.

In a series of cases, otherwise like those just described, the disease is present only on the palms of the hands and soles of the feet, the skin elsewhere remaining normal. In the milder cases, the epidermis of the palms and soles is only thickened, showing a moderate amount of epithelial exfoliation, and here and there a fissure. But its origin soon after birth, and the absence of external influences such as manual labor, etc., and above all its hereditary character, settle the diagnosis. Of course, manual labor will aggravate the disease, but when it is desisted from, the malady returns to its former state. This is easily explained from the fact that the formation of callus is favored by the existence of ichthyosis. In other cases, true horny excrescences are developed after the manner of ichthyosis cornea. A case of this kind affecting the soles of the feet has been described by Ernst.[2] In another case reported by Bœgehold,[3] besides the very considerable development of scales on the palms and soles, there was but slight epidermal thickening over the knees. I have observed the importance of heredity in these, as in the ordinary cases, in one instance in which, in a mother and son, the disease manifested itself soon after birth, was aggravated by manual labor, but did not disappear entirely when no manual work was done. More instructive in this respect is the family described by Thost[4] in which ichthyosis palmaris et plantaris was transmitted through four generations.

*Anatomy.*—It has been demonstrated that the ichthyotic scales consist of firmly coherent hardened epidermal cells, their long axis running parallel with the surface of the

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[1] "Descriptio Ichthyosis corneæ," Bremen, 1830.

[2] "De Corneis humani corporis excrescentiis," Diss. Berlin, 1819.

[3] Virch. Arch., Bd. 79, S. 545.

[4] "Ueber erbliche Ichthyosis palmaris et plantaris," Diss. Heidelberg, 1880.

skin, partly meeting the interpapillary furrows at a more or less acute angle. Between the lamellæ of the cuticle is found granular pigment in abundance, which normally is of rare occurrence. Sections of ichthyotic skin, apart from the frequent marked pigmentation and enlargement of the interpapillary cones, show that the horny layer has been very much thickened, whilst the deeper layers have undergone no essential change. The enlargement of the interpapillary cones is consequent upon hypertrophy of the papillary bodies. The hair-follicles often show indentations, and those familiar epithelial outgrowths from the point of insertion of the mm. arrectores pilorum, as seen in a number of other chronic skin diseases. Not rarely cystic formations originating in the sudoriparous and sebaceous glands have been observed. The *papillæ* are markedly elongated, but without any dendritic branching; and both in the course of the blood-vessels and in their walls, pigment granules in great number are found. Excepting the pigmentation of its superficial layers, the corium exhibits no pathological alteration.

Chemical analysis of the scales has shown a considerable increase in their inorganic constituents, especially in silicic acid.

*Etiology.*—Scarcely any other skin disease affords such direct proof of its hereditary nature as ichthyosis. Hardy goes even so far as to assert that if other members of the family are not found affected with ichthyosis, this disease will certainly be found affecting some near friend of the patients. There are many instances on record where the disease was transmitted from mother to son, and from father to daughter, although usually transmitted to those of like sex. Its frequent occurrence in brothers and sisters, without any external influences being recognized, is further proof of the hereditary nature of ichthyosis.

It was formerly supposed that *males* were more often than *females* the victims of this disease, but later observations fail to detect any such difference. With one exception, soon to be mentioned, race and climate have no genetic influence on the disease. Ichthyosis occurs endemically, according to a number of trustworthy observations. Buffon[1] reports it as being endemic in Paraguay. This is more marked in the Indian Archipelago, especially on the Molucca Islands,[2] where it affects five per cent of the entire population. Its hereditary nature is very evident in these localities. Males are affected almost exclusively. I do not think that its endemic occurrence is due to climatic peculiarities, but is attributable to its hereditary nature, and this the more so, because of its occurrence among a people living in isolated regions, usually islands.

*Course.*—Those afterwards affected with ichthyosis, are always born as perfectly normal children. The first evidences of the disease rarely appear before the end of the second month and then on the extensor surfaces of the extremities, especially of the knees and elbows. In the majority of cases, however, the disease manifests itself in the course of the first or second year of life. The further course of ichthyosis depends upon its intensity, and the maximum of development is attained usually about the time of puberty. Its maximum degree of development once attained, ichthyosis remains stationary throughout life, apart from slight fluctuations. Cases of actual recovery are among the rarest of exceptions. I know of only two such cases which were reported by Hebra.[3] In one instance, the ichthyosis disappeared after an attack of measles, in the other after variola. Its transient disappearance, particularly after severe general disease, has often been seen. In many patients a shedding process of the epidermis takes place, especially

[1] Cit. by Willan, "Die Hautkrankh. u. ihre Behandlung," Breslau, 1816, S. 149.

[2] Hirsch: "Hdb. d. hist. geogr. Path.," I. Aufl., B. ii., S. 470.

[3] Hebra and Kaposi: "Lehrb. d. Hautkr.," Ed. ii., S. 42.

towards the end of summer, leaving the skin temporarily with a more or less normal appearance. Ichthyosis has no effect on the general health of the patient.

*Prognosis.*—Concerning the general health the prognosis of ichthyosis is good; but the local malady is incurable. The cases reported as recoveries due to medication were in all probability incorrectly diagnosticated. Mild grades are of little importance, excepting the possibility of their further extension. The intenser forms, however, are quite serious, because of the deformity and impeded movement they occasion when certain regions are affected, and the painful rhagades common to them.

*Diagnosis.*—It might possibly be mistaken for Kaposi's second variety of xeroderma, but in this disease the skin is always thinner, and above all smooth, whilst even in the mildest cases of ichthyosis the furrows of the skin are exaggerated, and its surface rough. The milder grades of ichthyosis may, under certain circumstances, be confounded with diffuse psoriasis or lichen ruber, but the clinical history and primary efflorescences will guard against error. When most intensely developed, ichthyosis cannot be mistaken for any other disease.

*Complications.*—Concerning complications, little can be said. Not rarely, in cases of moderate severity, eczema is found in the flexures of joints, probably caused by the scratching and rubbing of the patient in trying to get rid of the crusts and scales. In an ichthyotic aged seventeen years, at the Breslau Clinic, psoriasis was observed to develop.

*Therapy.*—Little more can be done in the way of treatment than to alleviate the symptoms. The first indication is the removal of the abundant epidermal accumulations, which can be most speedily accomplished with soft-soap, or frequent baths and frictions with green-soap. In milder cases, the same end may be attained by injections of pilocarpine, the perspiration softening the scales which are then cast off. Such measures should then be adopted which will keep the skin supple, and prevent the reaccumulation of scales. For attaining this end, warm and vapor baths rank first, in conjunction with inunctions of ointments, whose composition is matter of indifference, provided they are bland. Internal medication has proven entirely useless.

## ICHTHYOSIS FOLLICULARIS.

Ichthyosis follicularis, in which the disease is limited to the *follicles*, is quite rare, Guibout[1] really being the only author who has furnished a detailed description of it. He improperly calls it *acne sebacea cornea*, and differentiates it from ichthyosis. Both diseases are pathologically alike, however, and vary only in their localization.

In the place of any further description, I shall offer the following report of an exquisite case of this variety of ichthyosis:

S—— Max, æt. 6 years. His mother and two brothers have normal skin; nothing can be ascertained concerning the father. A week or two after the boy's birth, his mother noticed the skin to be harsh, especially over the bridge of his nose, and over the edges of the auricles. Its present state was gradually attained. At birth the head was without any hair, and only during his third year did a scanty growth begin to appear.

*Present condition:* Over the extensor surfaces of the extremities, most markedly on the wrist and ankle, besides on the face over the brows, nose, and auricular edges, thin compact scaly columns, even as long as a millimetre, whitish or grayish in color, are seen projecting

[1] "Nouv. Leç. clin. sur les mal. de la Peau," Paris, 1879.

from a large number of follicles. The flexor surfaces and the trunk are very much less affected, and the palms and soles are entirely free. On the scalp, which centrally has a few isolated hairs, and peripherally a scanty growth, these epidermal spines may be seen projecting from a number of hair-follicles. The eyebrows are entirely wanting, and in this region the affection is very marked. Passing the fingers over the diseased parts produces a sensation like that caused by the prickly surface of a rose-leaf.

The treatment consisted of baths and spiritus saponis, systematically applied, whereupon improvement speedily followed, and the scalp having undergone the same treatment, an increased growth of hair became noticeable.

This form of ichthyosis and lichen pilaris are analogous in that excessive epidermal collections in and immediately around the follicles are common to both diseases; but, for all this, I believe they are distinctly separable, the scales of lichen pilaris lacking the cornification which characterizes those of ichthyosis.

## ICHTHYOSIS CONGENITA.

In this form, the scaling begins to manifest itself at an early period of intra-uterine life. Although the phenomena presented by this variety of the disease differ from those met in the ordinary form, I consider it incorrect to describe it as a distinct disease different from ichthyosis, since in both cases the pathological processes are similar. Children affected with ichthyosis congenita are usually born a month or two before full term. They present a most striking appearance: the entire surface is covered with larger and smaller plates of epithelium, separated from each other by deeper and shallower furrows. These plates and furrows in all cases maintain such a regularity of arrangement as to make all the children affected look alike. On the trunk, in most cases, the furrows run transversely; on the extremities longitudinally, except about the joints where they have a more transverse direction. The size of the plates varies from one mm. to several cm., according to the region in which they are formed. From external appearances, one would infer that, the skin having become too small, inelastic, and harsh, the growth and movements of the child caused it to rupture at those places where the strain was greatest. This assumption is confirmed by the condition of the skin around the orifices of the body, and on the hands and feet. The natural folds around the orifices are absent. The lips are wanting, the ichthyotic skin extending to the alveolar processes. The eyelids are also wanting, and the eyes are covered by the swollen and everted conjunctiva. No auricle is seen, but a hardened mass of epithelium can be detected narrowing the auditory canal. The anal orifice is on a level with the surrounding surface and has rhagades radiating from it. The skin on the hands and feet being more resistant, is without cracks; but the fingers and toes are shortened and bent, and the feet club-footed.

The condition of the hairs is important with regard to this view. They are not present in the centre of the furrows, but along the sides they may be seen taking an almost horizontal direction until they reach the scales, after which they resume their normal direction. As the hair begins to develop about the third month of intra-uterine life, it may be assumed that only after this period the skin becomes unyielding from the production of the thick horny layer, and therefore tears in those places subject to the greatest traction. The previously developed hair-follicles are naturally absent in the middle of these fissures, and in the lateral portions take a different direction, corresponding to the traction.

The thickness of the epithelial plates varies between one and five mm., and they are traversed by the elongated orifices of the sweat and sebaceous glands. All the children born with this disease died several days after birth. Apart from the self-evident fact that death is due to the intense modification of the skin, it is impossible for these children to suckle, on account of the oral deformity.

*Etiology.*—Nothing is known concerning the etiology of the disease. Okel, Sr.,[1] saw two cases of it in two children born of the same mother within a period of one year. The same invariably fatal malady has been observed in calves.[2] The *prognosis* being absolutely fatal, nothing can be expected from treatment.

We may here refer to those skin changes which have been falsely called ichthyosis circumscripta or acquisita, and are acquired later in life.

On the lower extremities, when the seat of chr. eczema due to varicose ulcer, or more especially when affected with *pachydermie*, changes resembling ichthyosis very much in appearance occur here and there on the surfaces thus affected. At times there is only an excess of epidermal scaling, without any hypertrophy of the papillæ, whilst at other times the papillary hypertrophy is so marked (the papillæ being closely packed together, several millimetres high, and capped by horny scales) that the surface has the appearance of a rough file. Similar appearances have been described affecting the mucous membrane of the tongue.[3] In these cases, the pathological changes are entirely local and due to an obvious cause, and not to a congenital pathological disposition of the skin to develop an excessive epidermis which is assumed to be the characteristic of ichthyosis. These changes of the skin, therefore, will be more properly denominated keratosis circumscripta.

## CALLUS.

Callus (callositas, tyloma) consists simply of a hypertrophy of the horny layer of the skin, without necessarily involving any of the other tissues. The horny layer may attain a thickness of several millimetres, and gradually shades off into normal skin. The area covered by callus varies in extent with the locality and the exciting cause; the entire surface of the sole and palm may be the seat of callus. Anatomically, only an increase of cells in the superficial epidermal layers can be demonstrated. The rete Malpighii, the papillary bodies, and the corium never manifest any appreciable change. The furrows and lines of the normal skin are still recognizable on the surface of the thinner callosities.

The cause of callus is long-continued intermittent pressure. The pressure is from within by the bones, especially where little tissue exists between the skin and bones, and secondly from without by wearing apparel, but particularly by various kinds of tools. The soles of the feet, but more especially the palms of the hands, are the localities most favorable to the development of callus. It occurs much more rarely in other regions of the body, and is explained by the occupation of the patient. On the foot, callus is oftenest formed on the heel and ball of the big toe. On the hand, callus is variously situated, and the occupation of the individual may be diagnosed from the site of the callus. I have seen callus develop on the back of the fingers in physicians who practised imme-

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[1] Cit. bei Lebert, "Ueber Keratose," Berlin, 1864, S. 108.

[2] Liebreich: "De Ichthyosa cong. intra-uterina," Diss. Halle, 1853.

[3] Lebert, l. c., S. 159.

diate percussion. Chemical and thermal irritants will also give rise to the formation of callus. When the pressure exciting the development of callus is suspended, the skin will resume a normal or nearly normal appearance. When, from any external cause, a suppurative inflammation is engendered under the callus, this may be thrown off in toto in a very short time.

The disturbances produced by callus are of minor importance, and it may even serve as a protection against external violence. Very thick callus, however, may interfere with tactile sensibility, and the unrestrained movements of the fingers—a matter of no little importance.

*Therapy.*—The main indication is the removal of the exciting cause, which is in most cases impracticable. The removal of callus itself offers no difficulty; softening agents, such as warm applications, sapo kalinis, and paring with the knife, are agents sufficient enough. This treatment is only of transient benefit if the exciting cause is not also done away with.

## CLAVUS.

A corn (clavus) is really a callosity, but presents certain characteristics peculiarly its own. It is a small thickening of the epidermis, from the centre of which projects a cone of horny tissue; this cone extends inwards into a depression of the corium. The papillæ and corium at the periphery of the corn are intact, the former being often hypertrophied; but in the centre, corresponding to the sunken end or root of the corn, the papillæ are atrophied or have disappeared, and the corium is thinner or even perforated. These changes are explained by the seat and origin of corns. They invariably occur where external pressure is exerted over a small circumscribed area against a bony prominence. Thus they are seen over the small heads of the phalanges and metatarsal bones on the soles of the feet; the central cone or "core" corresponds with the point of greatest pressure. It is evident that where external influences, oftenest badly fitting shoes, excite these epidermal formations, these horny developments in turn add to the pressure, and thus a circulus vitiosus results. Corns occur most frequently on the dorsal surface of the toes, and on the sole of the foot, more rarely between the toes and corresponding parts of the hands. Corns inconvenience on account of the pain they cause, and these may be so severe as to make walking difficult or even impossible.

*Therapy.*—The removal of the exciting cause, by procuring well-fitting shoes, is the first indication of treatment. This is not always easy to effect, especially when the toes are deformed. Rings of felt or adhesive plaster, applied over the parts most exposed to pressure, may prevent the return of corns, once they have been removed. Like callus, these horny formations are removed by emollients and the use of the knife. The dangers incident to cutting corns have been exaggerated, but at the same time it must not be forgotten that at the favorite seat of corns, small synovial sacs usually exist, which, if unluckily cut into, may lead to possibly serious results.

## VERRUCA.

Unlike the epidermal anomalies already treated of, in the development of warts the papillary bodies are also implicated. Hebra has divided warts into two classes, congenital and acquired; the first includes those pigmented, usually more or less diffuse and flattened elevations of the skin bearing hair, and which do not change as the

body grows. These formations are best considered as nævi, and will be described in another place.

We shall speak only of those warts that are always acquired, and originate in a hypertrophic development of papillæ and epidermis, and only exceptionally manifest any increased pigmentation. These true warts are flat, roundish tumors, considerably or only slightly elevated above the surface, and varying in size from a pea to a bean ; they sometimes coalesce and form larger plaques when the warts are numerous. At first their surface is smooth, and, if they remain small, continues smooth. When the wart grows larger and has existed for some time, the epidermis cracks, and the wart presents a surface analogous to that of a coarse short brush. They then assume a darker, blackish-green color, which is partly due to uncleanliness.

Anatomical research shows that warts consists of strongly marked hypertrophy of the papillæ and a corresponding deposit of thickened epidermis. The papillæ are very much lengthened, especially in the central parts, but are not branched, as in acuminated condylomata. As long as the epidermis of a wart remains intact, its surface is smooth.

Warts occur oftenest on the hands, and much less frequently on the face. On other localities they are very rarely seen, with the exception of one form, verruca senilis, which will be referred to shortly. Warts are most frequently met with in children and young people, but in adults almost solely in those individuals who perform manual labor. This factor, as well as the locality in which they are found, goes to show that a mechanical irritation has at least something to do with their development.

Warts have a tendency to drop off spontaneously, sooner or later, and do not re-appear (verruca caduca). But they often persist so obstinately and give rise to so much deformity that their spontaneous disappearance cannot be waited for.

*Verruca senilis* differs somewhat from this description, occurring, as the name indicates, only in the aged. The warts of old age are flat elevations with an irregular border, and measure one cm. or more in diameter ; they are usually of a more or less deep brown color. Their surface is never markedly cracked, but only moderately coarse, and they are usually quite numerous. They are most frequently seen in the face, back of the neck, and back. In old age the epithelial structures have a tendency to hypertrophy, and to this their origin is due. It is found that they present in the main an hypertrophy of the epidermis without implication of the papillæ.

Warts are best removed by scraping with a curette and subsequent cauterization. Patients who are "shy of an operation" may have their warts removed with caustics alone, and, in my experience, fuming nitric acid will best serve this purpose. Of course, these cauterizations must be repeated for some days, particularly if the wart is large, before it shrivels and falls off.

## CORNU CUTANEUM.

Horny excrescences early attracted the attention of observers, because of their striking appearance. These cutaneous horns consist of circumscribed excessive epidermal formations, simulating ichthyosis in so far as they may develop either from the skin generally or from the follicles; thus being analogous to ichthyosis dif., and ichthyosis follic. respectively, and in the latter instance develop generally from an enlarged sebaceous gland, or an erythematous cyst. Their shape varies. When their base is broad, they are short and irregularly cylindrical or pyramidal, the larger of them not measuring more than one to two cm. in diameter, and the apices are never pointed, but have a

weather-beaten appearance. The longer horns are usually twisted, sometimes making several turns. The horns originating in follicles may, under certain conditions, be subcutaneous, *i. e.*, they may develop within a closed atheromatous cyst. The surface is not smooth, and usually has longitudinal furrows; sometimes there are also transverse furrows besides, or a combination of both varieties. They usually present various shades of yellowish-brown. Their consistence is hard, though they are not as hard as the nails. Microscopic examinations show that these horns consist of hardened and thickened epidermal cells, but that, at least in certain instances, extraordinarily lengthened papillæ extend far up into them. The head is the favorite seat of these excrescences. Elsewhere their occurrence is much more rare, but relatively more frequent on the male genitals. Ordinarily there is but one horn, but sometimes they are multiple, as many as twenty having been observed on the same individual. As a rule, they develop only in elderly people, but I have myselfseen two of these excrescences on the under lip of a girl twenty years of age. These growths have a tendency to fall off spontaneously after having attained a certain size, only, however, to form anew.

On the whole, cornu cutaneum is very rare, and Hebra, in his immense experience, met with only three instances (1876). Aside from the deformity, and the pain at their roots due to the traction or pressure of the clothing, their removal is advisable because epithelial cancer is combined with them, according to Lebert, in twelve per-cent of the cases.

*Therapy.*—If those parts of the skin which form the base of the horn are not removed as well as the horn itself by an operation, a relapse may be expected. After thorough excision, no relapse is known to have occurred.

## CONDYLOMA.

Condylomata are excrescences of the skin oftenest seated on and around the genitals, and, though found in other localities, are caused by venereal disease. We shall therefore treat of them very briefly.

Acuminated condylomata are caused by irritation exerted by gonorrhœal secretions on the mucous membrane or skin. They begin as small pointed elevations which are quite numerous, and enlarging rapidly, they coalesce and present various shapes. On free surfaces, where they meet with no resistance, they assume a mulberry or cauliflower appearance; but where they are subjected to pressure, their form is modified accordingly. In the sulcus coronarius and anal fissure, their appearance is often like that of a cock's comb. Their surfaces, at first dry, become moist from a thin purulent discharge when they have attained a certain size, especially when cleanliness is neglected. This secretion may decompose in the numerous clefts and fissures between the individual parts of the condyloma, and stimulates their further growth. Their rapidity of growth is enormous, and they attain a considerable size within a few days. When neglected, they attain the size of a fist or even larger.

They are located exclusively on the genitals, the anus, and vicinity. Usually they first show themselves where the skin merges into mucous membrane, in men on the glans penis and inner surface of the prepuce, in women on the labia minora. Thence they may spread, especially in uncleanly people, to other parts of the genitals, to the anus, in women especially in whom this acrid secretion flows down upon these regions, even to the inner aspect of the thigh.

Anatomically, acuminated condylomata consist of an immense papillary hyperplasia,

the papillæ being very much lengthened and branching tree-like. The epidermic covering is comparatively thin, and the horny layer especially may even be absent, but on the other hand the layer of prickle-cells is very much developed. The size of the papillæ is proportionate to the number of blood-vessels entering them.

Acuminated condylomata are a purely local malady, and the prognosis is accordingly good. However, when neglected, they may give rise to fever and disturbed general health from the absorption of pus.

*Therapy.*—The treatment may be rendered troublesome by the great number of the growths and their tendency to relapse. Small condylomata are best removed with frequent applications of Liq. ferri sesquichlor.; but the larger ones should be removed with instruments and subsequently cauterized. The galvano-caustic snare is most advantageously employed for the removal of the largest variety, because their removal with the knife may give rise to very profuse and even dangerous hemorrhage.

Broad condylomata are syphilitic papules which assume a different form from ordinary papules of the skin on account of special local conditions. They are flat roundish elevations of a reddish-gray or gray color, often occurring in great number, particularly on the genitals and vicinity. They are also found in other regions of the body where the skin lies in folds, and opposing surfaces are in contact, as between the fingers and toes, under the breast, within the folds of the chin, at the naval, etc. Very often two condylomata are situated in corresponding localities so that they touch one another when the folds of skin come in contact. By their coalescence they may form large "beds." Their surfaces are moist, often eroded or ulcerated, and covered with a foul puriform fluid. The character of this secretion varies greatly according to the situation of the growth, and the cleanliness and care bestowed upon them.

These flat condylomata are secondary syphilitic lesions, and occur coincidently with other lesions of secondary syphilis.

Sections through them show a marked hyperæmia and hypertrophy of the papillary body and an infiltration of the corium and epidermis with numerous lymphoid cells.

Besides the appropriate constitutional treatment, they require cleanliness, separation of the opposing surfaces of the folds of the skin, and the local applications mentioned in all text-books on syphilis.

In conclusion we may add that it would be expedient to drop the name of condyloma for these affections, for they are etiologically entirely distinct formations.

It is therefore better to separate acuminated condylomata as papillomata entirely from broad condylomata, which are always a symptom of syphilis and may be called papulæ madidantes.

# ANOMALIES OF THE EPIDERMIS.

PART II.

BY

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## PSORIASIS.

Psoriasis is a chronic, usually relapsing skin disease, in which profuse quantities of silver-gray scales, which can be removed readily by the finger-nail, form upon more or less large, reddened parts of the skin, which are elevated to a trifling extent. Parts of the skin covered by thick, white, or grayish-yellow layers of scales, and which may remain unchanged for years, with occasional desquamation of the superficial scales, are found especially at the elbows, knees, scalp, glans penis. Small patches, particularly at the elbows, may be long overlooked. In other cases, there is a sudden appearance, either with or without moderate febrile disturbance, in many parts of the body of bright-red, somewhat elevated, usually more or less itching efflorescences, varying in size from a pea to a twenty-pfennig piece, and which are soon covered with a thick layer of scales. If the scales are scraped with the finger-nail until the red shining rete appears, very slight further scratching suffices to make small drops of blood appear, *i. e.*, the papilla has been injured.

This acute form is called psoriasis punctata; after a short duration it increases into somewhat larger patches, known as psoriasis guttata or nummularis. As the patches increase, the central parts often lose their scales, and present a normal appearance, except a slight brownish discoloration, so that rings remain (psoriasis annularis or circinata), but rings may also develop from the union of circular patches. When this occurs, the psoriatic changes disappear at the points of contact, and curved lines in the form of wreaths, etc., remain. The term psoriasis diffusa or inveterata is used when larger patches are affected without distinct circular boundaries. In addition, there is a general psoriasis, and in some cases very few centimetres of intact skin are present.

The external appearances vary according to the situation and duration of the process. Upon the scalp are found either exquisite forms of nummular plaques covered with thick white scales, or large, moderately scaly circular forms extending beyond the boun-

daries of the hair towards the forehead; more rarely, pale-red, slightly scaly, small patches, especially in nervous, anæmic individuals. Smaller patches, with a moderate amount of scales, predominate in the face. The extensor aspects of the limbs are the sites of predilection of large, often diffuse plaques upon an infiltrated base, and covered with thick, white to grayish-white scales. Very obstinate patches of a deep wine-red to violet color are observed especially on the calves of individuals who have to stand a great deal and suffer from varicose veins. All forms are found upon the trunk; not infrequently the patches on the anterior surface of the chest, particularly in old people, are covered with yellowish-gray, branny scales which are fatty to the feel. The penis is usually the site of small spots covered with few scales. The dorsal surface of the hand and fingers is rarely affected, but exceptionally an affection is observed solely on the palm of the hand, associated with marked thickening of the skin and a tendency to fissuring.

The abundance of the scales varies to an extraordinary degree. Their color varies from dull white to grayish-yellow; they are usually smooth upon the surface, convex, and have a smaller diameter than upon their lower surface which is generally smooth and even, but occasionally presents small sharp spines (depressions into the hair-follicles). They consist of several layers, are dry, and readily break.

The color of the skin beneath varies from a delicate pale-red or yellowish-red to deep-red; the redness often surrounds the scaly spots, especially when the process is extending. The skin usually presents its normal consistence, and is moderately thickened only in old patches or those irritated by mechanical or chemical causes.

In some cases, the psoriatic process always remains very slight; in a few, patches persist for a long time, after a more or less violent eruption of psoriasis has reached its termination. In a third series, more or less extensive outbreaks follow one another at short intervals. The general condition often suffers considerably in such cases, in which the individual occasionally is covered with scales from head to foot. The general outbreak occurs with febrile disturbances; the patient must keep to bed, movements are annoying, even painful, because the reddened and tense skin readily fissures. A fatal termination has been observed exceptionally in this form which is very similar to acute pityriasis rubra.

Although, as a rule, the hair does not fall out even after psoriasis of the scalp of long standing, the occurrence of complete, incurable alopecia is not very unusual in some cases.

In inveterate, extensive psoriasis, the nails of the fingers and toes are usually implicated secondarily in the pathological process. They are very much thickened at the free edges, become laminated, have deep points like a thimble, or opaque, yellowish-white streaks; in places, irregular pieces break off, so that occasionally only small, deformed remnants adhere to the matrix. In some cases, the nails may, for a long time, constitute the exclusive site of the process.

It is more than doubtful whether true psoriasis occurs upon the mucous membranes. Bazin described as psoriasis buccalis ivory-white, occasionally bluish, shining, smooth, irregular opacities of the epithelium with normal interspaces.

If this callus-like process is more extensive, deep fissures, which often suppurate at a later period, readily occur in the underlying tissue during mastication. This affection has also been observed with syphilis, smoking, dyspeptic symptoms, after long-continued mechanical irritation from sharp carious teeth, in psoriasis[1] and lichen planus.

[1] Vierteljahrschr. f. Dermat., Schwimmer. In case VII., a leukoplakia preceded the psoriasis for some time.

Like warty formations on the skin, it is not infrequently the starting-point of carcinoma, particularly upon the lips and tongue. Cartaz[1] reports the transition of a psoriatic patch of a finger into carcinoma.

Laycock[2] obtained the following results with regard to the sensibility of the patches: 1st, tactile sensation is diminished; 2d, this diminution corresponds to the extent of the process; 3d, it is most marked upon the patches themselves; 4th, no accurate observations could be made concerning pain and temperature, but their diminution is usually insignificant.

Psoriasis usually begins in later childhood and youth, but not infrequently it occurs in the first years of life, or in mature years.

A peculiarity of psoriasis and some other dermatoses is its disappearance in severe febrile diseases, and its re-appearance after recovery.

*Etiology.*—The causes of the disease are shrouded in obscurity. Neither climate nor diet has the slightest influence upon its development, but it appears to be more frequent in certain races, perhaps on account of more frequent intermarriages. The entire series of constitutional diseases, which are supposed to be produced by micro-organisms, have been regarded as mediate or immediate predisposing factors; thus syphilis of the parents, tuberculosis (Wilson regards psoriasis as the analogue of pulmonary tuberculosis), malaria, etc. Wertheim maintains that he produced psoriatic efflorescences by the injection of penicillium glaucum and the fungus of beer into the vessels. Vivier[3] is thoroughly convinced of the parasitic nature of psoriasis.

The similarity of the clinical history of psoriasis to that of the dermatomycoses, particularly herpes tonsurans, led E. Lang[4] to the supposition that a fungus is the cause of the former disease; and later he succeeded in discovering the fungus. This is situated in Bulkley's so-called psoriasis skin (thin rete layer immediately above the papillæ). The fungi are readily visible after the addition of a five-per-cent solution of potash. They are round or oval bodies, with a very shining membrane having a double contour and colorless protoplasmic contents, almost as clear as water, but somewhat granular with the most powerful lenses. The diameter of these brood-cells (spores ?) is 6–8 $\mu$ in width and often twice as much in length; in places they are constricted, or present outgrowths. Lang observed them grow, after the lapse of two or three hours, in potash 5.0 with glycerin and water āā 50.0. The contents and membrane of the young cells are similar to those of the blood-cells; the free end is rounded or enlarged. Endogenous development of spores appears to occur in these enlarged ends. The hyphi are rarely segmented; occasionally, there are links arranged like a necklace of pearls; and, exceptionally, they present lateral sprouts. They are stained with great difficulty. Lang includes this fungus among the hyphomycetes, and calls it epidermidophyton. To cure psoriasis permanently, he requires that the patient remain under treatment until the affection is entirely removed. With slight modifications, his treatment is that ordinarily employed.

In my own investigations, I often found the brood-cells represented by Lang in Fig. 1 in the epidermis cells treated with a solution of soda, especially in the younger rete cells of eczema vesicles, pityriasis versicolor, etc. (I regard them as artefacts, as myelin-like (?) exudations). I have not detected the culture products in potash and glycerin.

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[1] Gaz. des Hôp., 1878, p. 751.

[2] Med. Tim. and Gaz., March, 1871, p. 271.

[3] Ann. de Dermat., vol. i., p. 287.

[4] Vierteljahrschr. f. Dermat. u. Syph., 1878; and "Ueber Psoriasis," Volkmann'sche Sammlung, 208.

It has long been observed that in psoriatic individuals typical efflorescences develop with preference in places subjected for a long time to a mechanical or chemical irritant,

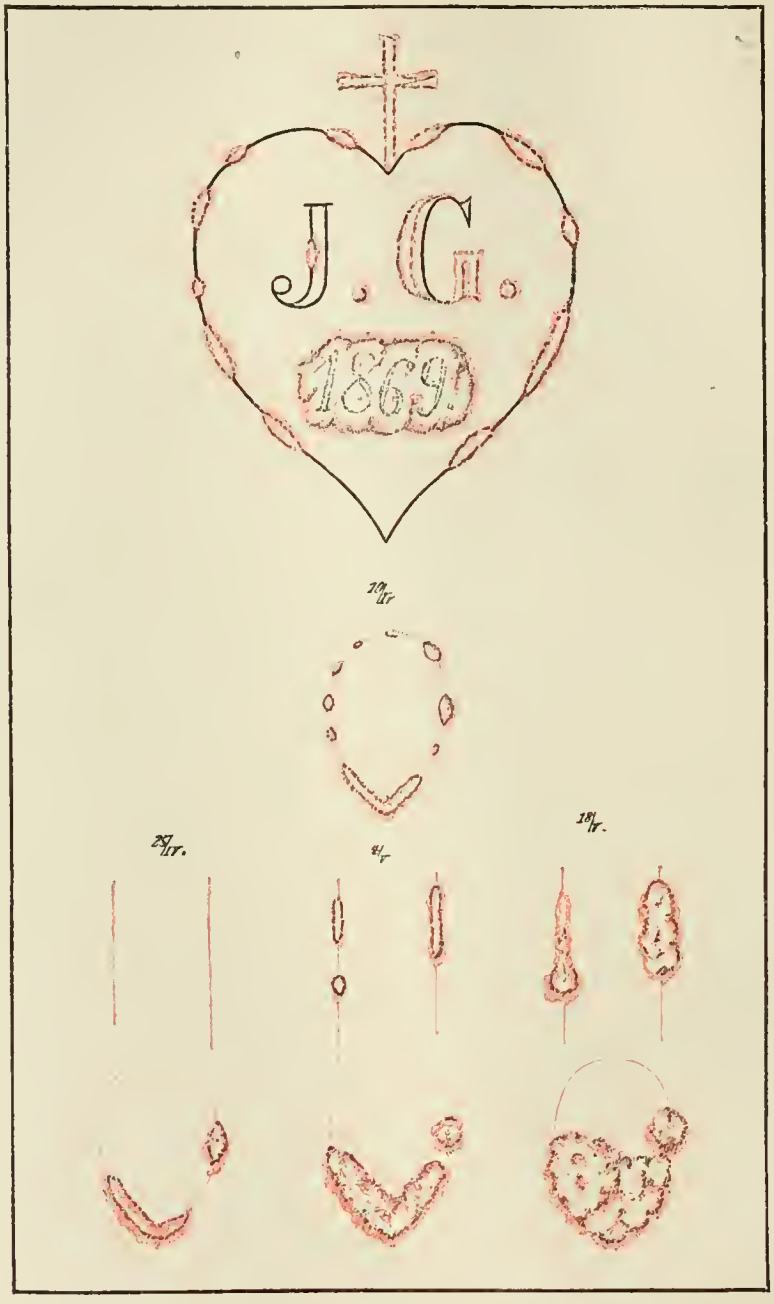


Fig. 20.—The uppermost figure represents the tattooing changed by the psoriasis eruption; the figures provided with dates show in succession the phases of the parts artificially irritated.

as after vesication, mustard poultices, cupping, at points of pressure from tight articles

of clothing, etc. This peculiarity has been utilized by Kœbner[1] in the experimental production of psoriasis by stratching with the point of a needle. At the time of a fresh outbreak of the disease or in extensive psoriasis, he has succeeded in producing typical plaques of the disease in any form desired upon artificially injured spots. According to Kœbner, this vulnerability of psoriatic individuals can be diminished or even extinguished by the therapeutic action of arsenic internally or tar externally.

Much more frequently, conditions of debility of a mental and physical character awaken the slumbering tendency to psoriatic efflorescences, for example pregnancy, lactation, exhausting labor, excesses in baccho, fright, etc.

Heredity plays a very prominent part in psoriasis, is perhaps its sole cause, and offers numerous opportunities for the observation of its various peculiarities (atavism, etc.). No rigid proof can be brought at present that psoriasis develops de novo or can be produced mechanically or chemically.

Bazin regards it as a constitutional diathesis, mainly hereditary, which is either of arthritic or herpetic origin, and gives, as he imagines, the characteristic differences of both forms. Others assume principally a single unknown internal cause, the dartrous diathesis.

It seems to me that only two explanations are possible: 1, to regard it as a chronic toxic disease like syphilis and leprosy; this is opposed by the fact that in these affections changes may develop in all organs; or, 2, as seems more probable, that it is due to a functional weakness of the nervous centre regulating the nutrition of the skin, dependent on hereditary taint; this view is favored by the constant, monotonous form of the efflorescence, and its tendency to symmetrical development. The anatomical process is merely the peripheral projection of the functional central disturbance.

It is a peculiar feature, which has not been considered sufficiently heretofore, that not all dermatoses may be combined, and that a number of them exclude one another. Thus, syphilis has no effect on an existing psoriasis, and in like manner all skin diseases produced by mechanical or chemical noxious influences (causes externes, parasites, medicinal ingesta, etc.), may be associated with it. According to Neumann, prurigo and ichthyosis have never been found associated with psoriasis.

*Anatomy.*—The most recent patches of psoriasis, before the appearance of scales is noticeable, show redness of the papilla; the view that psoriasis is not a primary affection of the rete is supported by the fact that it never occurs upon cicatrices in which the papillary body is not entirely intact. Only after the circumscribed redness with superficial scaling and the other characteristic appearances permit a diagnosis, can we follow the further pathological changes, as those parts of the skin of the psoriatic individual which appear intact, present no abnormality under the microscope.

In accordance with the earlier investigations of Wertheim, who found enlargement of the papillæ and markedly dilated coils of the papillary vessels, and those of J. Neumann, who, in addition to vascular dilatation in the cutis and papilla with perivascular round-cell proliferation, demonstrated considerable development of the rete and horny-cell layers, Hebra[2] found the rete layer developed more than normally, enlargement of the papillæ from œdematous infiltration and perivascular cell proliferation; the latter is very marked in old patches, which also present pigment granules in the deeper rete layers, and in the papillæ and corium.

A. R. Robinson[3] found that the enlargement of the papillæ was only apparent, due

[1] Jahresber. d. schles. Gesell. f. vaterl. Cultur," 1872, and Lecture in Berl. Med. Society, 1878.

[2] Lehrb., ii. Aufl., S. 335.

[3] Arch. of Dermatol., vol. vi., 1873, and Jamieson, Edinb. Med. Journ., 1879, p. 622.

to proliferation of the rete and especially the projection of the interpapillary prolongations of the rete into the cutis. A slight true enlargement of the papillary body is only produced by a very moderate swelling of the connective-tissue bundles, by the hyperæmia and extravascular production of lymphoid-cells.

His view that the primary anatomical process consists of proliferation of the rete, and not of hyperæmia of the papillary body, is based on the following reasons: 1, the enlargement of the interpapillary projections stands in no causal relation to the dilatation of the vessels in the papillæ; 2, small epithelial outgrowths occur even when no hyperæmia can be perceived on account of the deep situation, as in the external root-sheath of the hair which is the analogue of the rete; 3, the hyperplasia of the rete occurred even when he removed two adjacent pin's-head plaques with the intervening healthy skin; here the change in the rete extended beyond the apparent border of the two papules, so that

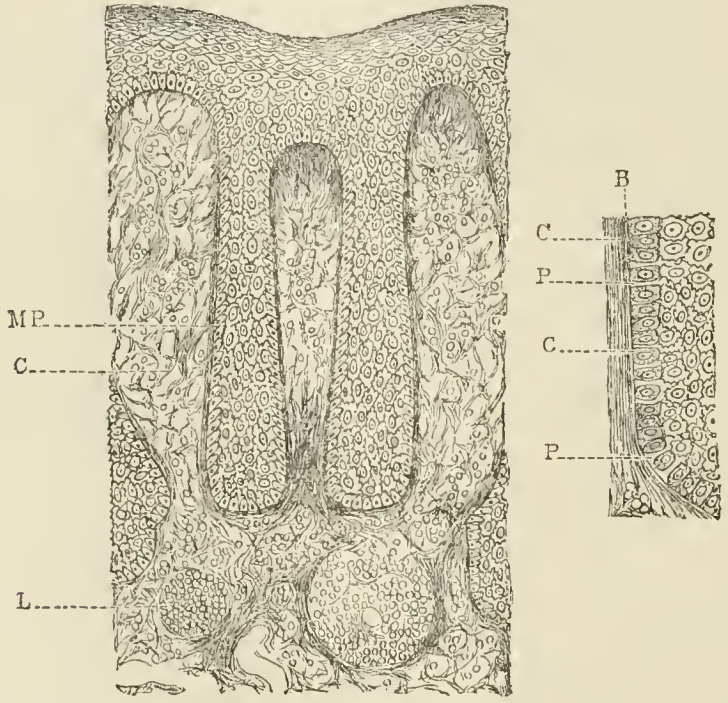


Fig. 21.—Section of a patch of psoriasis, after Jamieson. M P, the elongated interpapillary cones; C, infiltrated papillæ; L, dilated vessels filled with blood-globules.

they were closer together in the deeper than in the superficial parts. (Could R. measure the size of the papules so accurately during life, especially when the question is of such a subjective character, as to determine where a macroscopic change, *i. e.*, a slight redness of the skin, which as a rule passes gradually into the normal color, has reached its limits? Author.) Robinson found the vessels of the papillæ and upper parts of the corium dilated with profuse proliferation of round-cells around them, also lymphoid cells around the ducts of the sweat-glands and sebaceous glands. He attributes the elevation of the plaques to the hyperæmia and infiltration of the cutis rather than to the rete changes. In inveterate patches the rete prolongations often become very much elongated and thickened at the lower end, and there is round-cell proliferation around the dilated vessels. Exceptionally the smooth muscular fibres become hypertrophic.

In the recovery of psoriasis, the enlarged interpapillary prolongations shrink to their former shape, the vessels become narrower, and the cellular perivascular proliferation, like the serous exudation in the connective tissue, is absorbed; but the hyperæmia continues after the absorptive processes are completed, and abnormal discoloration usually remains at the site of the plaques.

Jamieson found cells often with three nuclei in the hyperplastic rete prolongations, and the presence of prickle-cells extending to the palisade-shaped cells immediately above the papilla; this he regards as the sign of active hyperplastic processes in the rete.

J. Neumann[1] found the palisade-shaped rete-cells present in several (up to four) layers; in the lowermost rete layers the cells rapidly assume a horizontal position, nucleus and nucleolus become enlarged, the filling of the cells with granules rapidly increases from below upwards (granular layer) so that we often can count six rows, the prickle-cells are not present in abundance (?), the most marked cell proliferation occurs in the interpapillary prolongations, in places these are connected with one another by offshoots, by which means the papillæ degenerate into thin, thread-like prolongations and, on the other hand, passive congestion is maintained in the coils of vessels. The papillæ are elongated twelve to fifteen times the normal (?) and new-formed in places (?), their tissue infiltrated with round-cells, the coils of vessels dilated in some places, narrowed in others; in the upper parts of the cutis the bundles of connective tissue are broader than normal, and the dilated vessels surrounded by proliferated round-cells. The smooth muscular fibres are hypertrophic, some of the lymphatics dilated, the cells of the sweat-glands and hair-follicles increased and their excretory ducts filled with horny cells. In some cases there was dilatation of the sweat-glands and round-cell proliferation around their membrana propria. The hair-follicles present numerous nipple-like outgrowths.

*Diagnosis.*—Psoriasis of the scalp must be distinguished from 1. *pityriasis* or *dry seborrhœa;* this usually extends over the entire head without distinct limits, the apparently normal skin is covered with fine, whitish-gray scales; in rare cases there are circumscribed, pale-red, scaly plaques which are only distinguished from those of psoriasis by their very pale redness, slight branny desquamation, and the usual coincidence of general pityriasis of the head. 2. *Eczema:* in this there are moist patches next to scaly ones, the amount of scales is small, there is a tendency to the formation of yellowish firm crusts; it is not circumscribed and presents no circular borders. 3. *Lupus erythematosus* (Cazenave). The scales have an opaque gray color, usually are not very abundant, and are embedded in the skin; the hairs fall out in these places, and after removal of the scales the skin in the centre usually is somewhat depressed and has large pores (as if worm-eaten); depressed, atrophic, non-scaly patches of a bluish-red or whitish color are rarely absent upon the head and ears, and there are bluish-violet patches covered with thin scales upon the vermilion border of the lips. 4. *Favus* is characterized by its musty odor, gray crumbling crusts, dull look of the hairs which readily break.

Psoriasis of the trunk and limbs must be differentiated from 1. *a squamous syphilide:* this develops from brownish or copper-red, shining papules, which are usually quite elevated, and, during their involution, are covered with more or less profuse grayish-white scales. Beneath the scales of the syphilide the skin is colored brown, depressed, atrophic, and the plaque has a more sombre color, while a bright arterial redness predominates in psoriasis. While syphilis is characterized by various other forms of eruption present at the same time, psoriasis on the whole is very uniform. Upon the delicate

[1] Wien. Med. Jahrbuch, 1879, S. 67.

integument of the penis the differentiation of psoriasis from a scaly, specific patch is especially difficult. In some cases it is also very difficult to differentiate the scaly, tylosis-like syphilide of the palm of the hand and sole of the foot from the corresponding psoriatic affection. In the specific process, the brownish-red, wall-like infiltration at the borders of the scaly patches is rarely absent. Rhagades are not infrequent complications of both processes. The scaly affection of these parts produced by eczema is distinguished from psoriasis by the fact that, after the removal of the scales in the former, the eczematous change becomes visible. In addition, more recent eczematous changes may often be observed upon the lateral parts of the fingers. In some cases in which the process spreads to the dorsum of the hand, the diagnosis can only be made by the absence of psoriatic efflorescences in other parts of the body. The diagnosis is equally difficult in many cases of diseases of the nails, as psoriasis, eczema, lichen ruber, tricophyton tonsurans of the nails present the same clinical appearances.

*Chronic eczema* of the forearm and lower limbs can only be distingished from inveterate psoriasis of these parts by the absence of the circular borders, the smaller quantity of scales, and the more marked thickening of the cutis.

Scrofulous children may present a circumscribed circular form of eczema, especially upon the dorsum of the hand, the forearm, and face. This eczema is distinguished from the nummular form of psoriasis by its elevation, slight scaling, the deeper color of the plaques, and the coincident occurrence of distinct eczematous changes in other parts.

The primary efflorescences of lichen ruber, which are rarely absent as scattered polygonal, shining, faintly colored nodules, are so characteristic that they cannot be mistaken for the bright-red, readily bleeding, primary efflorescence of psoriasis, which begins to scale very early. Upon the integument of the penis, however, the lichen nodules are arranged occasionally in the form of small circles, which are almost exactly like psoriasis, but the abundant formation of scales and the smooth structure of the base of psoriasis are wanting. Larger nodules of lichen planus are covered with few scales, have a granular surface, are infiltrated rigidly, and at the borders its composition out of individual nodules may be observed, while psoriasis scales profusely, has a smooth, readily bleeding base, and at its borders passes gradually, without any elevation, into the normal skin.

*Pityriasis rosea* is distinguished by its more rapid course, slighter branny scale formation, yellowish color in the centre, absence of hemorrhage after removal of the scales, and its localization mainly upon the thorax.

General psoriasis can only be distinguished from *pityriasis rubra* if the primary characteristic efflorescence of psoriasis can be found; the former, as a rule, does not last very long, the latter may continue unchanged for years.

In doubtful cases the patients must be examined carefully from head to foot.

*Treatment.*—No measures should be employed which give rise to injuries of the skin that heal by cicatrices, since psoriasis never heals in this manner. Recovery may be secured, 1, by internal, 2, by local remedies.

None of the measures employed is capable of preventing a relapse.

Of the large number of drugs recommended, I will mention only those which have proven useful in practice: above all, arsenic which, in fresh (*i. e.*, not yet treated) and not very extensive cases, is often sufficient to effect recovery. Fowler's solution,[1] with double

[1] Best prepared fresh and kept in a well-stoppered bottle; the drops should be carefully counted with a drop tube.

the quantity or more of peppermint water, should be administered during or after meals, in three to five doses, or it may be taken with wine. Hebra began with six drops daily and, if well tolerated, increased one drop every two or three days, up to twelve drops daily, then if recovery was delayed, increased more slowly until twenty or even thirty drops daily were administered. If the psoriatic patches began to disappear, he gradually returned to the original dose.

In larger doses, signs of arsenic poisoning appear—conjunctivitis, dryness in the throat, gastric disturbances and pains—and the dose should then be diminished. During its administration, acid, spiced articles of diet and those which are laxative, also beer should be avoided; furthermore, arsenic is contra-indicated in chronic diarrhœa and dyspeptic symptoms. Another unpleasant though not so frequent symptom of the use of arsenic is the occurrence of various eruptions of the skin; in addition, after the cure of the psoriasis, a deep brown to sepia-colored discoloration (taches arsenicales) often remains at the affected spots. Hutchinson [1] observed the development of herpes zoster during the administration of arsenic.

Hunt [2] begins with eighteen to twenty drops of Fowler's solution daily, divided in three doses, and remains at this quantity for two to three weeks; if no improvement occurs, he increases the dose one-fifth, and repeats this increment once or twice a month until improvement takes place. If improvement begins, he remains at the dose then given until complete recovery ensues. Attention should always be paid to conjunctival symptoms as a measure of the toxic effect.

Arsenious acid [3] was employed by Hebra mainly in pill form (Asiatic pills [4]), one-tenth grain in each pill. "In the majority of cases, the continued administration of three pills daily, given at one dose, immediately before a meal, proved sufficient, but in obstinate cases I have increased the daily dose to twelve pills and continued this undiminished for many months." In other cases he administered arsenic and opium.[5]

In addition to arseniate of soda [6] in pill form, Biell also employed arseniate of iron.[7]

By means of the subcutaneous injection of arsenious acid, Lipp [8] has endeavored to avoid the injurious effects of arsenic upon the stomach, and has observed rapid effects in such cases. A number of the cases treated by me in this manner showed no encouraging results, the injection is often very painful, causes moderate, occasionally phlegmon-like, suppurating infiltrations, and in addition the preparation must always be made fresh.[9]

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[1] Med. Times and Gazette, Dec., 1868.

[2] "Treatment of Skin Diseases."

[3] According to Gorup-Besanez, "Anorg. Chemie," IV. Aufl., S. 281, there are two forms of arsenious acid, the crystalline and the vitreous or amorphous, produced from the former by heating and which passes into the crystalline form in the air. $As_2O_3$ is soluble in water with difficulty (1 : 20), the vitreous modification being more soluble than the crystalline. Both are more readily soluble in hydrochloric acid and in water containing it than in pure water.

[4] ℞ Acid. arsenic., 3.6; Pip. nigr. pulv., 24.0; Gummi arab., Aq., q. s. ut f. pil. No. 600. To be mixed very carefully.

[5] ℞ Acid. arsenic., 0.06; Opii, 0.24; Sapon. med., q. s. ut f. pil. No. 16. Sig. Take two morning and evening.

[6] Sodæ arseniat., 0.1; Extr. hydro-alcohol. cicutæ, 1.30; M. ft. pil. 24. Sig. One to two pills daily.

[7] Ferri arseniatis, 0.15; Extr. lupul., 4.0; Pulv. alth., 2.0; Syr. aurant. cort., q. s. ut f. pil. No. 48. Sig. Take one pill daily.

[8] Arch. f. Dermat., 1869.

[9] Vide Huseman's "Arzneimittellehre," 1875, S. 831.

All methods of administration, however, are often useless, and it has scarcely any effect in preventing relapses. It is, therefore, advisable to combine local treatment with the internal use of arsenic. Tar water internally is useless, as are also the carbolic acid pills recommended by Kaposi, and they may produce toxic symptoms. A similar danger is threatened by the use of tincture of cantharides (Rayer), increasing from four drops daily to thirty drops (!!).

Oleum phosphoratum, 2–5 drops t. i. d.; copaiba balsam, 4–6 gm. daily have also been recommended. Of greater value are the decoction of species lignorum and the subcutaneous injection of pilocarpine. Campana recommends its use in grown people with rigid skin, marked scaling, diminished nutrition and tonus of the skin, and also when the nutrition in general has deteriorated and other diseases are present. The alkalies and tinctur. colchic. (1–4 gm. daily), recommended by Bazin in arthritic psoriasis, were always combined with the external application of tar and alkaline vapor baths, so that definite therapeutic conclusions cannot be drawn therefrom.

External remedies are much more certain in their action than internal ones. At times, maceration of the affected skin is sufficient to produce recovery, for example, baths prolonged for hours in a tub or in natural thermal waters, or warm sulphur baths. As a rule, however, this merely removes the scales, and effective remedies, such as preparations of tar, must then be applied.

In the application of tar in psoriasis, the scales must first be removed, so that the remedy may act directly on the diseased skin. This can be effected by protracted baths, as mentioned above, and by rubbing the scaly parts with spiritus saponato-kalinus[1] or pumice stone. Less advisable are scratching with the sharp spoon, on account of the violent mechanical irritation; also rubbing with ether or solutions of salicylic acid. Softening of the scales by more violent caustics, such as acetic acid, solution of potash (1 : 2 to 10) is advisable only in very obstinate cases and when the skin is very thick, particularly in psoriasis of the palm of the hand.

The use of tar has some injurious effects, which occasionally contraindicate its further application. Sometimes a single application is so irritating that an acute dermatitis develops. In other cases it is used with advantage for a long time, but then the so-called tar acne develops. At first, merely the excretory ducts of the sebaceous glands and hairs are visible as black, somewhat elevated points, but little pustules soon take their place. When the applications are made to large parts of the body, we should always bear in mind the possibility of toxic symptoms from absorption; children in particular are very sensitive. The symptoms may be preceded by the passage of dark-colored urine, fever develops with nausea, vomiting, dizziness, and headache, black watery stools; the urine, of an inky black to olive-green color, giving a distinct odor of tar upon the addition of sulphuric acid. These symptoms usually disappear in a short time with the copious excretion of urine. Even a fatal termiuation, especially in children, has been observed from inunctions of tar ointment in scabies.

The application may be made either pure or diluted, once or twice a day, by rubbing it in with a stiff brush, after which the patient should either remain in bed for a number of hours under woollen blankets or he may attend to his ordinary avocations after the parts have been powdered with soapstone and bandaged with flannel. As the tar adheres very firmly to the clothing, it is advisable to wear flannel underclothing next to the skin. If the scaling continues for some time, the old layer of tar with the scales should be removed with soap spirit before a fresh application is made.

[1] ℞ Sapon. virid., 50.0–100.0; Alcoh. rectif., 100.0; Macera per hor. xxiv. filtr. Add. Eau de Cologne or Spirit. lavand., 10.0.

These may also be combined with advantage with protracted baths, the tarred patient remaining for hours in a warm bath. In a like manner, Hebra has made applications of the modified Vlemingkx' solution[1] (either with or without protracted baths), after the scales have been removed with pumice stone; but this method is quite painful in extensive psoriasis.

The products of distillation of tar and coal, such as naphthalin, resineon, carbolic acid, have proven of little service; this is also true of the $\beta$ naphthol recommended recently by Kaposi.

The inconstant Rochard ointment[2] and the proto-iodide ointment must be used with extreme caution, on account of the violent pustular dermatitis to which they give rise.

Treatment with caoutchouc has proven useful. Rubber-cloth, used as a bandage or article of clothing, does not absorb the products of excretion from the skin, and these soften the integument. But its employment over the entire body is not devoid of danger, as several cases of serious acute dermatitis have been observed in consequence. It is useful to combine applications of tar with rubber bandages.

Priesnitz's hydropathic measures act in a similar manner. The patient is placed in wet linen cloths and then wrapped in woollen blankets. After perspiring profusely for a number of hours, he is placed in a cold bath with douche, in which he is rubbed with cloths. He is then placed in a dry-pack for a little while.

An occasionally effective but heroic method of treatment is the soft-soap cure. With a brush or piece of flannel, soft soap is rubbed upon the infiltrated spots until they bleed, small portions of the body being treated each time, so that about a week is required to treat the entire body in general psoriasis. The patient, who is kept in woollen blankets during the entire period of treatment, remains in them for several days longer until profuse desquamation occurs, and he is then given the first bath.

The therapeutics of psoriasis has received recently a valuable addition in chrysarobin, which is obtained from Goa powder (from Angelim Amargoso in Bahia, Brazil).

Chrysarobin in used in the form of ointment (5–20%), being slowly rubbed with warmed fat for a few hours in an oil-bath. It must be remembered that chrysarobin causes a discoloration of the clothing (at first yellow, then blue or violet upon being washed with soap) and also of the hair, and that its application to the scalp, therefore, is excluded. By means of a brush the ointment is rubbed, at first once, then twice a day, upon the psoriatic patches which have been deprived of scales, and the parts then covered with a flannel bandage or flannel underclothing worn next to the skin. If the formation of scales continues, they must be removed repeatedly.

After repeated inunctions, a punctate, later diffuse redness, and occasionally marked swelling appear at the points of application and in their vicinity. But almost from the first appearance of the redness, the psoriatic patches come out distinctly by a peculiar play of colors, a bright ring forms around them, and while they gradually fade into a pale rosy color, the neighboring parts still remain very red. If the inflammatory redness becomes painful or the psoriatic patches have remained destitute of scales and of a pale color for a number of days, the inunction is discontinued or is only repeated after the inflammatory symptoms have subsided for a few days.

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[1] ℞ Calc. viv., 500.0; Aq. font., q. s. ut f. pulv. æquabil. ℞ Flor. sulf., 1,500.0–1,000.0; Aq. font., 10,000.0, Coque usq. ad remanent 6,000.0, filtra. This contains $CaS_2$, $CaS_6$, and oxidation products of S.

[2] ℞ Iodin. pur., 0.7; Calomel, 1.25; Leni igni fusis add. Unguent. rosat., 60.0.

If the hands have been treated with chrysarobin, it may give rise to violent conjunctivitis by coming in contact with the eyes during the night, and it is, therefore, advisable to wear gloves at night.

Even after extensive inunctions, Kœbner[1] was unable to discover the drug in the urine, nor did he observe symptoms of absorption or albuminuria. Lewin and Rosenthal[2] state that, after its use in rabbits, they detected it in the urine together with symptoms of nephritis.

Pyrogallic acid,[3] in a 5–10% solution or in the form of ointment, applied once or twice a day with a brush to the patches of psoriasis, is slower in its action than chrysarobin, but is useful, is unattended with noteworthy inflammatory symptoms, and does not stain the clothing as deeply as the latter drug. Rubbing with soap upon the affected parts and full baths must be taken a number of times during the treatment. Light-brown discoloration of the skin occurs at these spots and can be removed by benzin; the inunction must be repeated until scaling ceases. Upon the application of stronger solutions (to 20%), the formation of vesicles and necrosis of the skin occurs, attended by great pain. In extensive psoriasis, the drug should be employed with extreme caution, *i. e.*, not applied to too large parts of the skin, as grave symptoms of absorption with a fatal termination may ensue. Neisser[4] has reported a case of this kind.

Rufigallus acid has been used by Neumann[5] and Lang,[6] but it acts more slowly than chrysarobin and pyrogallic acid, and also stains the clothing. It is employed by Lang with oil with a strength of 10% in the form of ointment. Kœbner[7] has observed good results from the application of powdered zinc, free from arsenic, in the form of ointment.

In addition, appropriate treatment must be adopted for any anæmic, dyspeptic conditions, etc., which may be present. In a few cases, entire change of diet has had favorable effects.

## LICHEN PLANUS.

Lichen planus is characterized at the onset by very small (not one-half to one-quarter as large as the head of a pin) polygonal, flat elevation of the skin, of a normal color, or slightly yellowish. Extraordinarily small papules, in groups, with a shining, somewhat excavated surface, can be observed, especially upon the delicate integument of the penis. In a little while they become higher and broader, assume a deeper color (yellow, deep cherry-red to bluish-violet), and thus constitute the lichen papules described by Wilson as "shining, smooth, and flat," which often, though not constantly, present a shallow excavation. This excavation occupies the entire surface of the papule, and its deepest point is in the middle, which only exceptionally, however, corresponds to the excretory duct of preformed tegumentary structures. At a later period, the little nodules, which have become somewhat larger, and occasionally somewhat more pointed, become covered with a very thin coating of scales, which are removed with considerable

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[1] Paper read before the Berl. Med. Gesells., 1878.
[2] Virch. Arch., Bd. 85, S. 118.
[3] Wien. Med. Jahrb., iv., 1878, S. 78. Wien. Med. Blätt., May, 1878.
[4] Zeitschr. f. Klin. Medicin, Bd. i., 1879, S. 88.
[5] Wien. Med. Blätter, 1879, 22.
[6] Volkmann'sche Sammlung.
[7] Verbal communication.

difficulty. At first, the nodules are arranged in groups over a small space, and then gradually develop in the intervening normal spaces, thus forming larger or smaller plaques (l. aggregatus, Wilson); others remain as individual typical nodules (l. discretus, Wilson). The lichen plaques are elevated, of a violet or bluish red, copper red to deep violet color. Small whitish points and streaks, with ramifications, are seen embedded even in the smaller ones, and these give to the larger ones a peculiar appearance. The larger plaques are covered with a few scales, which often project like thorns, have a granular surface, and, at the edges, but separated from the normal skin by a steep red border, they present whitish miliary spots. More rarely, medium-sized plaques are observed, which feel between the fingers like firm infiltrations spreading deep into the skin, similar to tumors of the skin. On the body, the nodules are often arranged in the segment of a circle, in some cases in the shape of a cockade, in other places the little nodules have arranged themselves in straight or whip-like curved lines, corresponding to pressure of the clothing or the tracks of scratching by the nails. Especially upon the penis and scrotum flat, angular nodules extend along fine white streaks which spread in many directions from a white point like a spider's web; the entire figure is covered with thin scales of a silvery lustre.

An affection which, as it seemed to me, is not rare in England, is the occurrence of moderately large plaques of lichen upon the knee; they are extraordinarily firm, and covered with a few scales. They often continue unchanged for a number of years, and ordinarily cause pruritus.

While the disease slowly spreads for months, and finally affects the entire integument, some nodules and plaques undergo spontaneous resolution. The nodules sink in and leave a depression with more or less deep-brown discoloration. In like manner the plaques leave a shallow, atrophic, sepia-colored depression, which only disappears after a long time.

New, very small papules often form in the shape of a ring around such a discolored portion of skin. In other cases (usually those of long standing), papule follows papule, so that, for example, the entire anterior aspect of the thorax is converted into a uniformly red, thickened portion of skin, covered with the finest scales; in addition, numerous pointed nodules project from their midst, giving the feel of a grater. In the cases of general lichen described by Hebra, the entire integument was thickened, so that motion was impaired, and slight fissures of the skin occurred on the flexor aspects of the joints. The nails were usually thickened, uneven, brittle, opaque and brownish, but the hair was unaffected.[1]

The disease begins without constitutional symptoms; in many cases the nodules are only revealed to the patient by sight; in others, pruritus is present from the beginning.

I have seen almost all parts of the body, except the face, affected affected primarily by lichen planus. As a rule, however, very large portions of skin present a few elevations from the beginning. The flexor side of the forearm, the integument of the penis with the glans, the scrotum, sacral region and abdomen, are the favorite sites of the affection; secondarily, no part of the integument is spared, and papules have been observed even upon the tongue, cheek, and pharynx.

Lichen mainly affects individuals between the twentieth and fiftieth years, but

[1] In a case of general lichen under my observation, the hairs had fallen out, the papular, syphilide-like, hard, conical, copper-colored eruption covered the entire body; in addition, there were depressed, atrophic, discolored portions of skin.

Kaposi has observed the disease in a child eight months old, and in two children between three and four years old. The statements with regard to sex vary. The disease seems to be much more frequent in the better classes, but its causes are unexplained.

At times, the lichen appears to be preceded for a long time by an affection of the nails.

*Anatomy.*—In opposition to previous observers, R. Crocker,[1] believes that the anatomical process at the onset is a superficial inflammation independent of the hair-follicles, and he distinguishes two varieties. In one, the cellular infiltration which starts from the upper wall of the vessel of the uppermost part of the cutis, constitutes three-quarters of the height of the papule; the excretory duct of a sweat-gland often passes through the middle of the papule; the infiltration starts abruptly from the normal parts. In the other series, the papule consists of proliferated rete cells, the horny layer in the centre of the papule is very much thickened, and sinks like a funnel in the correspondingly depressed rete, which, upon the desquamation of the horny layer, causes the umbilicated appearance. The interpapillary prolongations project somewhat deeper than normal; the infiltration in the papillæ does not occur so abruptly as in the first case. The sweat-ducts often appear to determine the localization of the papules.

In the larger plaques of lichen, Neumann[2] found the chief changes in the upper layers of the cutis. The layer of horny cells is thickened, and there is considerable increase of the rete, especially the prickle-cells, the nuclei of which are granular and swollen. The papillæ are enlarged, their vascular coils broader and twisted, the adventitia proliferated; the proliferation is much more considerable beneath the dilated vessels. In the upper part of the connective tissue of the cutis, the proliferated cells are arranged in islets or in meshes. No changes in the hair-follicles and sebaceous glands. Parenchymatous changes in the sweat-glands develop early; they become broader, and are surrounded by proliferated cells. According to Neumann, the whitish-gray miliary objects, which are visible macroscopically, consist of these pathologically changed sweat-glands (?). In the later stages, rusty brown and black pigment is found free, and in the cells of the upper parts of the cutis, the papillæ, and the adventitia of the vessels.

From sections of the earliest papules, I conclude that the process begins as a perivascular proliferation of the vessels of the upper layers of the cutis, and is followed by an infiltration of cells into the papillæ, following the course of the nerves.

*Diagnosis.*—Disseminated lichen must be distinguished from *papular eczema*. The latter is recognized by the brighter redness, greater size, more conical form of the papules, and also by its speedy conversion into the vesicular, pustular, or squamous forms, or in recovery. In *psoriasis punctata*, scales accumulate rapidly upon the reddened spots, which are very little elevated, and at the first very small plaques undergo peripheral concentric growth, while the plaques of lichen are composed of smooth, polygonal, flat, shining, but firm papules, which are very little or not at all scaly. Furthermore, psoriasis is never followed by cicatrices, or cicatricial atrophy of the skin with intense brown discoloration, as in lichen. The latter disease is often mistaken for the small *papular syphilide*. But the latter is almost always attended by severe constitutional symptoms and pains in the bones and muscles, and is rarely attended by pruritus. Upon close

[1] Lancet, 1881, Feb. 19th, p. 285.

[2] Vierteljahrschr. f. Dermat., 1875, "Ueber eine noch wenig gekannte Hautkrankheit (Dermat. circumscr. herpetiform.)."

inspection, moreover, the papules are pointed, round, often covered with a brownish crust; when plaques develop, the centre is almost always depressed and copper-colored. In addition, the tendency of syphilis to polymorphism of eruptions is present.

In the very rare cases of general lichen in which the characteristic primary eruption cannot be discovered, a diagnosis is often impossible.

*Treatment.*—According to Hebra and Wilson, arsenic is the sovereign remedy, and its action is much more certain than in psoriasis. The method of administration is the same as that employed in psoriasis. Hebra gave three to twelve Asiatic pills daily in three doses; six weeks are said to elapse before its effect is produced. But such large doses are not always necessary, especially since a number of cases have a tendency to spontaneous recovery. Kœbner has secured recovery in a very short time by small quantities of Fowler's solution, injected subcutaneously. Wilson recommended corrosive sublimate externally, in small doses, and Vidal extols, in addition to bitters internally, the external application of glycerolé d'Amidon, 20.0; tartaric acid, 1.0, and baths with vinegar (1 litre to the bath). W. Boeck[1] recommended oxidizing remedies internally, especially chlorate of potash and nitric acid. T. Fox[2] recommends asafœtida and mercurials, in addition to nourishing diet. Unna[3] recently has employed, with good success, inunction of the entire body with: unguent Wilsoni, 100.0; acid. carb., 4.0; corrosive sublimate, 0.1 to 0.2, the patient then being kept in woollen blankets for a week. He has seen recovery under this treatment in six weeks (?). Prof. Kœbner has recently employed with success subcutaneous injections of pilocarpine.

Local remedies, such as tar, Costar's paste (tincture of iodine and tar, or, more properly, iodine, 7.5; colorless oil of tar, 30.0) or other irritants, weak solutions of potash, soft soap, solutions of thymol, etc., have often proved sufficient in the plaques of lichen which remain localized. The pruritus must be treated symptomatically. The internal administration of arsenic often ameliorates the pruritus within a few days.

## LICHEN ACNEIQUE. LICHEN CIRCINATUS.

This disease is characterized by small pointed papules, usually of a dull red color, the tip being covered often with a yellowish or grayish-brown crust. The papules are either scattered irregularly or grouped in arcs or circles. In addition to these papules which appear to correspond to the hair-follicles, there are somewhat elevated red discs, scarcely as large as a twenty-pfennig piece, which are covered with a slightly irregular, grayish-yellow, thin crust. The crust is clearly defined by a steep, wall-like, circular border. Rarely we find pale papules, from the tips of which a clear drop exudes, and also pale-red spots, which look as if brushed with a gum-like fluid. In addition, we sometimes find irregularly defined, somewhat scaly patches, about as large as the hand, and of a yellow to a bright yellowish-brown color; these are surrounded by the small, pointed red papules, and by brownish punctate depressions. The site of predilection of the acne-like papules is the sternal and interscapular region, but they may be present also on the remaining parts of the thorax and back. The large yellow plaques are found particularly on the abdomen and thighs.

Yellowish, irregular, flat patches are found occasionally on the legs; they scale very little and grow somewhat pale on pressure with the finger. In its milder grades as acne-

[1] Arch. of Dermat., vol. i., Taylor.

[2] Med Times and Gazette, 1873, vol. i., p. 540.

[3] Monatshefte für pr. Dermatolog., Hft. i., 1882.

like papules, the disease is remarkably frequent in men from the twentieth to the fortieth years, and often becomes annoying on account of the pruritus. Its duration is variable, but it may last for months or years. In rare cases it begins suddenly and spreads rapidly.

*Etiology.*—Nothing is known positively concerning its etiological factors. Occasionally there was very profuse perspiration, in other cases pallor of the face with a flat thorax; the majority of the patients were vigorous and well built. In one case, slight psoriasis and occasional violent epistaxis were also observed. The wearing of flannel, to which the disease has been attributed, was denied in the majority of cases. The affection is very similar to lichen scrofulosorum, but it does not present the symptoms of scrofula, such as glandular enlargements, etc.; it is also distinguished by the age at which it appears, by the absence of the complications of lichen scrofulosorum (acne with a hemorrhagic border, scrofulous eczema of the genital region), and also by its localization, since the milder grades of lich. scrof. affect mainly the abdomen.

R. Crocker[1] has found, in the scales, mycelia and spores similar to those of pityriasis versicolor in size and shape; in order to demonstrate them better, he employs ether and chloroform. They are situated mainly in the papules, not in the scaly patches. He regards the disease as an abnormal pityriasis versicolor.

My own observations have never resulted in the discovery of fungi which are similar to the Mikrosporon furfur. Crocker's spores are very like the Torula communis, which is found in scales of the most varied origin.

So far as known, the disease is not contagious.

The affection often resists for a long time the use of active remedies; it may disappear apparently, but in a few weeks resumes its former status.

*Diagnosis.*—We must differentiate: 1. ordinary *acne;* in lichen acnéique the often merely punctate crusts are situated upon a pointed, superficial, pale-red elevation, which corresponds apparently to the excretory duct of a sebaceous gland; acne constitutes more deeply-seated, broad, hard, deep-red papules of varying size, often painful on pressure, and which usually have purulent contents; in addition, comedones are also present, and the yellowish plaques described above are never observed in it. 2. *Lichen scrofulosorum.* 3. *Pityriasis rosea:* in this there are circular discs with a red areola, while, in lichen, the prominent feature is an irregular boundary of those parts of the skin which are stained more deeply, with peripheral formation of papules and acne-like little nodules. 4. *Eczema papulosum:* the long duration of the individual papules, the polymorphism, arrangement and localization of the eruption, facilitate the diagnosis. 5. *Pityriasis versicolor:* in this disease, the patches may be removed like a membrane, and the fungus may be discovered without difficulty; in addition, no pointed papules are found.

*Treatment.*—This consists mainly of the application of tar, soft soap, soap spirit, Wilkinson's ointment, white precipitate ointment. Crocker recommends inunctions with natrium subsulfurosum, 1.0, with 9.0 fat; or thymol, 1.0, vaseline, 15.0. In obstinate cases, the internal administration of arsenic is recommended.

## PITYRIASIS RUBRA. DERMATITIS EXFOLIATIVA GENERALIS.

Pityriasis rubra is a very rare, usually chronic disease, with a fatal termination, in which the skin has a deep-red color throughout, and is covered with large lamellæ of scales.

Gibert (1860) gave a good description of some cases of this disease. In one, the face

[1] Lancet, Oct., 1881, p. 742.

escaped, the forehead was dry, thickened, covered with whitish fine scales; the skin in general felt like parchment, the desquamation occurred in large lamellæ like the layers of an onion, the scales were adherent at one edge, and were removed by rubbing; the skin was then seen to be reddened. The pityr. rubr. was preceded occasionally by a vesicular eruption; during its course, weeping occurred only at the very tense and consequently ruptured places; the nails were elongated and bent. The affection ended fatally by marasmus.

Under the term "herpetide exfoliatrice," Bazin[1] includes this affection, together with other dermatoses, such as eczema, psoriasis, pemphigus, which are associated with profuse scaling. These diseases may pass into one another, and finally, after enormous production of scales, terminate fatally from some intercurrent disease.

E. Wilson[2] includes under the term dermatitis exfoliativa, not alone a primary affection, but also the terminal stages of various profusely scaling diseases, in which the absence of primary or characteristic eruptions renders the diagnosis impossible.

Hebra[3] stated that pityriasis rubra "is unaccompanied by any other symptom than a constant, intense dark-red color, without notable infiltration, formation of papules or fissures, without weeping or formation of vesicles; it is associated with slight itching, and almost always spreads over the entire integument." The redness disappears on pressure, giving place to a yellowish color. At the places which are free of scales, the skin occasionally has a vitreous, glistening red color, through which the deeper parts of the skin are visible. The temperature of the skin is somewhat elevated, but subjectively there is a feeling of chilliness. At the beginning, there is a branny desquamation, but later the scales become larger. The affection begins at various parts of the body, with deep-red scaling patches. Alopecia and changes in the nails occur during the disease. The patients may pursue their occupation for years, until emaciation, the feeling of tension in the skin, its diminished elasticity, secondary changes (fissures, gangrene), and impaired nutrition gradually cause the fatal termination from phthisis, nephritis, or some other intercurrent disease. The disease affects particularly males in the prime of life.

Hans v. Hebra[4] reports a case in which the autopsy revealed a solitary tubercle of the cerebellum, in addition to pulmonary and intestinal tuberculosis. Fleischmann states that he has found cerebellar tubercles post-mortem on several occasions in children who had suffered from a cutaneous affection similar to pityriasis rubra.

Chronic pityrasis rubra does not always appear to begin with red, scaly patches, since in one of H. v. Hebra's cases the eruption was preceded by an impetiginous eczema of the scalp.

Kaposi[5] believes that he cured one case, and also reports that a colleague suffered from pityriasis rubra, which terminated favorably.

*Dermatitis Exfoliativa Acuta.*—Corresponding to the chronic form of pityriasis rubra is the acute, usually benign form which has been described under various names. It often occurs with slight febrile or general symptoms, at first usually in the form of round, red infiltrated discs, like circumscribed dry, more rarely moist eczema, which soon becomes covered with branny scales and itch moderately. The

[1] "Affections cut. arthrit. et dartreuses."
[2] Med. Times and Gazette, 1870, i., p. 118. Lectures 1870–78.
[3] "Hautkrankheiten," i. Aufl., 1862.
[4] Vierteljahrschr. f. Dermat., 1876.
[5] "Vorlesungen," S. 393.

redness spreads from the chest over the trunk and limbs, nor does the face escape; the horny layers scale off in stripes or in large lamellæ, which may even be two inches in length. Slight weeping may occur in some places; in others, a few flabby vesicles appear; the tense skin occasionally fissures on the flexor aspects of the joints. The nails and hair sometimes fall out. The skin returns to the normal in a few weeks, but relapses occur in a number of cases. In individual cases, the affection is restricted to the hands, and the horny layers may be drawn off like a glove.

It cannot be determined at present in how far we should include in this affection cases of so-called erythema toxæmicum after surgical operations, the scarlatina-like eruption after similar causes and in puerperal processes, also the scarlet eruption after typhoid fever, at first circumscribed, which terminates in branny and large shredded desquamation, also the similar exanthem after the administration of certain drugs, such as hydrate of chloral, quinine, digitalis, and also after extensive treatment with caoutchouc.

T. Fox [1] observed as a sequel of pityrias. rubr. that the hair-follicles presented themselves in rows with scales in their excretory ducts. This condition he calls pityriasis pilaris (lichen pilaris) and regards as characteristic of a preceding pityriasis rubra, but a similar appearance is observed occasionally after extensive psoriasis.

Byers[2] reports a case in which pityriasis rubra developed in an ichthyotic girl.

Liveing[3] regards pityriasis rubra as variety of eczema: he found that a slight exudation between the layers of epidermis is never absent. He also observed that albuminuria was always present, and that an improvement in the condition of the skin corresponded to a diminution of the albumin in the urine.

J. Hutchinson[4] includes under the term pityriasis rubra the usually fatal terminations of various chronic, symmetrical, obstinate affections of the skin, which are characterized by marked desquamation, thickening of the skin, absence of exudation. He assumes that they are due to a degeneration of the spinal cord.

*Anatomy.*—The anatomical changes in pityr. rubr. were studied by H. von Hebra[5] in two cases. In one he found a thick horny layer, a thin rete with infiltration cells, then the connective tissue profusely infiltrated with cells and numerous well-developed elastic fibres, here and there yellowish-brown pigment in the connective tissue; the papillæ had disappeared, the sweat-glands and sebaceous glands were absent, the hair-follicles and hairs very scanty. In the second case the epidermis and rete were of normal dimensions, the papillæ and subcutaneous connective tissue filled with a cellular infiltration, hair-follicles and sweat-glands present in abundance, no accumulation of pigment; small cells were collected around the vessels and sweat-glands.

B. Baxter[6] described the following changes: the rete Malpighi was not separated distinctly from the horny layer, as the zona granulosa had disappeared entirely; there was a very gradual transition from the polygonal rete cells, which stained readily, to the flat scales of the stratum corneum which remained colorless. Flattened, feebly stained nuclei, which lay parallel to the surface, could be recognized even in the uppermost layers of the enormously thickened horny layers. The papillæ were moderately enlarged, the interpapillary prolongations of the rete extended somewhat more deeply than nor-

[1] Med. Times and Gazette, 1873, i., p. 487.
[2] Ibid., 1880, ii., p. 375.
[3] "Diseases of the Skin," 1878.
[4] "Lectures on Clinic. Surgery," 1879.
[5] Vierteljahrschr. f. Dermat., 1876.
[6] Brit. Med. Journ., July, 1879.

mal. The cells of the hair-follicles appeared to be increased. According to Baxter, the almost muscular consistence of the thickened cutis at the beginning of the disease is due mainly to a fluid exudation which is absorbed before death.

The causes of the chronic and acute varieties are unknown.

*Diagnosis.*—The diagnosis of chronic pityriasis rubra is rarely easy. Redness, desquamation, moderate infiltration of the cutis are found in dry eczemas and in psoriasis, but in the latter there is a greater accumulation of scales than in pityr. rubr. and the papilla is injured and made to bleed more readily in psoriasis. Circumscribed plaques of pityr. rubr. and the dry forms of eczema which are not always preceded by a moist stage are often exactly alike. The diffuse forms of pityr. rubr. chron. are distinguished at once from general psoriasis and lichen planus by the characteristic primary eruption. It is distinguished from pemphigus foliaceus by the absence of stinking secretion, the dryness of the scales, the absence of eroded moist patches after the scales have been removed.

*Treatment.*—Treatment of the chronic form is almost hopeless. Applications of tar and inunctions of fatty substances often diminish the pruritus, and render the skin more supple; protracted baths after the application of tar act in the same manner. Diuretics are indicated when albuminuria is present and the perspiration is extraordinarily diminished. Great importance must be attached to a nourishing diet and roborants. The same indications hold in the acute forms, but these usually present a tendency to spontaneous recovery.

## DERMATITIS EXFOLIATIVA INFANTUM (V. RITTERSHAIN).

G. Ritter von Rittershain[1] has observed a symptom-complex, which he described as dermatitis exfoliativa infantum, in a large number of children, from the age of about six days to five weeks. They often presented quite a marked dryness of the skin, usually with branny desquamation. The disease begins generally around the angles of the mouth, with a diffuse, at first pale, later deep-colored erythema, with a tendency to the formation of rhagades. The buccal mucous membrane is dark-red, with small, irregular, superficial losses of substance. The process spreads from the face to the trunk and limbs. The epidermis separates, usually after a small amount of fluid exudation has accumulated underneath it, in other places crusts form; the upper layers of the skin can be removed readily by slight mechanical action. The uncovered rete has a dark, flesh-red color, is shining, and dries in a few hours. The process of exfoliation gradually extends over the entire body; the thick horny layer of the hands and feet can be stripped off like a glove. Instead of drying of the rete, regeneration of the upper layers often occurs, attended with branny desquamation. The duration of the disease is usually seven to ten days.

The disease varies greatly in severity; it runs its course usually without fever or gastric disturbances. After recovery, the skin has a normal color, but presents a tendency to eczema. Furuncular eruptions always occur as a sequel, and lead to phlegmons, gangrene, and perhaps to a fatal termination from sepsis; this occurs in scarcely half the cases. Mild relapses occur sometimes after the lapse of about two weeks. It presents great similarity to the infectious diseases, but is not contagious. It occurs sporadically and epidemically. Boys are affected more frequently than girls.

[1] Centralztg. f. Kinderheilk., 1878, Bd. ii. Arch. f. Kinderheilk., 1880, No. 53.

*Diagnosis.*—It must be differentiated from erythema neonatorum, which occurs shortly after birth, while dermatitis exfoliativa develops, at the earliest, at the end of the first week; from erysipelas, which is always attended with increased temperature; from pemphigus, in which the non-affected parts have a normal color and the vesicles are distinctly formed.

*Treatment.*—V. Rittershain recommends roborants, nourishing diet, baths of 25° R., loosely applied clothing, application of dusting-powder to the eroded places, removal of crusts and scales with fine almond oil. Good results were obtained also from baths to which a decoction of finely cut oak-bark (100.0 oak-bark to 1 litre water boiled one to one and one-half hours, filtered, and ½ litre of the decoction added to a bath) was added. In furunculosis the pus must be evacuated.

## PITYRIASIS ROSEA (GIBERT).

Described by Gibert as pityriasis rosea, and by Bazin as pityriasis rubra maculata and circinata, Horand[1] recently gave a detailed account of it under the term pityriasis circinata. The Vienna school deny its separate existence, regarding it as herpes tonsurans maculosus.

The disease often begins with mild fever, then little red patches, scarcely as large as a twenty-pfennig piece, and very slightly or not at all elevated, appear upon the throat or thorax; they are covered with a few branny scales, sometimes with a coherent, silvery-gray scale. In a few days, the patches spread concentrically, the central part is yellowish and covered with the finest scales, and peripherally the redness passes insensibly into the normal color. The affection spreads over the entire body, but rarely affects the face. If the scalp is involved, it looks like circumscribed, circular pityriasis simplex, but the hairs remain unchanged. If two or more enlarging circles coalesce, the redness disappears at the point of junction, and slight desquamation occurs. Pruritus is not a constant symptom. The disease lasts from four to six weeks and recovers spontaneously.

Horand assumes external agents as the cause; it appears to be not infrequent after profuse perspiration. According to this writer, it is not infrequent in childhood, particularly in boys; according to Bazin,[2] it occurs in the first half of life, especially in lymphatic, scrofulous individuals.

E. Vidal[3] has found, in this affection, very small spores scarcely 1 $\mu$, rarely 3 $\mu$ in size; they are arranged in circles in the epithelium of the upper and middle layers of the epidermis, but occasionally in heaps in and about the epithelium; rarely chains of spores are seen, five or six spores have a diameter of less than 1 $\mu$, and look like small black points arranged in lines. Clinically, however, Vidal distinguishes pityriasis circinata from pityriasis rubra; the latter lasts four to six weeks, begins at the middle of the thorax or back, spreads symmetrically over the trunk and limbs, while pityriasis circinata begins here and there without symmetry. The latter description leads me to consider Vidal's pityriasis circinata as identical with pityriasis rosea. On account of its varying size, he calls the fungus Mikrosporon anomæon s. dispar. Similar micro-organisms (cocci) are found in the scales of other desquamating dermatoses.

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[1] Ann. d. Dermatol., Bd. vii., S. 325.

[2] "Affections Cutan. Artificielles," 1862, p. 226.

[3] International Medical Congress, 1881.

*Diagnosis.*—It must be distinguished from the erythematous and pityriasis-like stage of herpes tonsurans; the latter usually presents circles of vesicles, is separated sharply from surrounding parts, the tricophyton is found readily, and it yields only to energetic treatment.

It presents great similarity in some stages with lichen acnéique; the latter also shows yellowish discoloration of the skin, with branny scales in the centre, but the periphery of a lichen plaque usually contains small reddish papules which are covered occasionally with small dark crusts.

It is distinguished from a syphilitic roseola by the absence of desquamation in the latter, its normal centre, and the dark cherry-red color of the roseola, while in pityriasis rosea the centre is yellow and somewhat scaly, the periphery rose-colored or pale-red.

*Treatment.*—Active treatment is contraindicated. River-bathing or luke-warm baths, with or without the addition of soap, soda, dusting-powder, and the like may hasten its course. The pruritus must be treated symptomatically.

## PEMPHIGUS (ERUPTION OF VESICLES).

In pemphigus, vesicles develop over the entire body, either at once or in a number of exacerbations separated by variable intervals. It is divided accordingly into the acute and chronic forms.

Until recently, the existence of acute pemphigus was denied by eminent dermatologists, but its existence can no longer be doubted. It is not rare in the new-born and infants, and also in children to the age of four years, and occurs often in extensive epidemics. In a large number of cases it is undoubtedly contagious. Its frequent occurrence has been observed in maternity and infant hospitals, as well as in private practice. In 1841, Scharlau[1] reported a small family epidemic, and successfully inoculated himself with the contents of the vesicles. Thomas[2] reports a case in which a child suffered from the acute eruption twice in the same year. The disease often begins without general disturbances, occasionally with febrile movement, which is repeated at every marked exacerbation, and with vesicles which appear usually within two to ten days after birth, particularly in the neck and groins. In one case, pemphigus developed before birth (Winkel, Dresden, 1879). The eruptions follow irregularly, and often run their course in two or three weeks; in other cases, their duration may be prolonged over a number of months. Healthy as well as feeble children are affected, and the prognosis can never be made with certainty. An unfavorable termination occurs usually as the result of digestive disorders. With or without the previous formation of papules, more or less large, tense vesicles develop within a few hours; their contents soon become opaque, and are discharged, so that crusts rarely form; the rete is then laid bare, and has a reddish, often glistening look. The face is little affected, the palms of the hand and soles of the feet almost never. The vesicles have been observed occasionally upon the conjunctiva and buccal mucous membrane. Some authors mention the simultaneous occurrence of puerperal disease in the mothers. The action of the inoculated secretion of the vesicular contents develops in twenty-four to seventy-two hours, and is attended with burning, redness, and formation of vesicles.

Roeser always found micrococci in the contents of the vesicles. P. Gibier[3] (de Sa-

[1] Caspar's Wochenschr. f. ges. Heilkunde, 1841.

[2] Arch. f. Kinderheilkunde, 1868, Bd. 44, S. 4 u. 5.

[3] Gaz. d. Hôp., 1881, Nos. 124–126. Ann. d. Dermat., 1882, 2.

vigny) describes the bacteria of acute pemphigus as a row of links, 2.5 $\mu$ in length, arranged in the form of a rosary, the threads consisting of two to twenty links, being 4 to 40 $\mu$ in length. The individual bacteria and the threads are very mobile; he also found bacteria arranged in zooglœa form. The bacteria are found in the fresh vesicles and in the urine.

On account of the repeated occurrence of pemphigus neonatorum in the practice of a midwife who bathed the children in too hot water, Bohn looks upon cutaneous irritants as the cause of the disease.

The infectious character[1] of pemphigus is also shown by the fact that adults, coming in contact with the affected children, do not escape, although the general condition is not affected seriously. In older children and adults, the disease may give rise to the clinical appearances of contagious impetigo, and there is no doubt that a number of cases of impetigo contagiosa are really localized contagious pemphigus.

The same contagious property of the secretion, especially the pus, has been demonstrated experimentally in many other pustular eruptions (eczema, scabies, etc.).

Acute pemphigus of adults is rarer than the acute contagious pemphigus of children. Vesicles from the size of a pea to a hazel-nut, usually upon somewhat elevated, reddened patches, develop either with or without a febrile prodromal stage and general disturbances. The vesicles are filled at first with a clear, watery fluid, which becomes more or less purulent after a while. Beginning upon the trunk and limbs, the eruption spreads over the entire body. The buccal mucous membrane is often affected; without distinct formation of a vesicle, the epithelial covering of the mucous membrane is removed, and the latter often looks red, though it may be changed into a grayish-white, diphtheria-like, readily bleeding surface. If the wall of the vesicle is removed, the corium sometimes appears as a smooth, reddened surface, sometimes, particularly when the vesicles are very large, it is uneven and granular; a deeper loss of substance is observed only exceptionally. If the vesicular contents dry into crusts, their color will be light or dark, according to their previous contents. The consistence of the vesicles also varies, sometimes they are tense, sometimes flaccid.

The course of the disease varies as greatly as its duration. It does not always terminate in a few weeks in recovery; even in adults, the occasionally high fever produces severe symptoms, even a fatal termination.

Acute pemphigus has been observed a number of times in pregnant women, in some cases accompanying the various pregnancies, and thus constituting a natural transition to herpes graviditatis (Bulkley); also shortly after delivery. It has been observed also in drinkers, a fatal termination occurring rapidly, attended with delirium.

Chronic pemphigus varies considerably in its duration and course. There are cases in which the eruption occurs from time to time for months, so that at no time is the body entirely free. In other cases, long intervals elapse between the relapses. The disease may be benign or malignant; the more frequent the relapses, the greater the extent of surface occupied by the vesicles, and therefore of the secreting surfaces; the greater the danger of septic infection from the extent of the integument which has been laid bare, the more markedly the mouth and pharynx are implicated—the more unfavorable will be the course of the affection with regard to the life of the individual.

Chronic pemphigus begins frequently under the form of a polymorphous erythema,

[1] Ballard (Med. Times and Gazette, 1871, i.) reports a case of the communication of pemphigus from a cow to a human being. Gibier states that the disease occurs in asses, horses, sheep, and oxen.

and retains this character for a number of weeks; then larger and smaller vesicles appear upon the formerly erythematous patches. In other cases, the vesicles develop upon a more or less reddened, occasionally normal integument. Their size is very variable, from that of a pea to such an extent that it hangs down like a flaccid bag filled with fluid, and as large as the hand. Even upon the buccal and pharyngeal mucous membrane, separation of the upper layers of the membrane occurs not infrequently; they become macerated very rapidly and, on account of the unfavorable localization of the affected parts, assume a diphtheria-like appearance, with marked swelling of the tongue, salivation, fœtor ex ore, difficulty in swallowing, etc. However, a cleaner appearance of the parts and new development of membrane ordinarily occur very rapidly. Kleinwaechter[1] has described vesicles and eroded patches in the vagina in chronic pemphigus.

Upon the skin, recovery with the formation of cicatrices rarely occurs, but the rete becomes covered with the normal layer of horny cells; a light to deep sepia-brown discoloration often remains at the site of the former vesicle. More rarely, very firm papillary (stalactite-like) proliferations develop gradually upon the thickened subcutaneous tissue of places in which vesicles have continued to develop. The sites of predilection of such hyperplasiæ are the integument in and around the axillæ, that of the genital and inguinal regions, and the dorsal surface of the foot.

Fever and more or less severe general symptoms not infrequently accompany the various eruptions, but quite frequently they afterwards subside. Pain is not very noticeable; the patients complain merely of burning, tension, and disagreeable traction, produced by the adherent bandages and clothing. A more serious symptom is the insomnia, since, apart from the fact that it is not infrequently a prodromal symptom of a new eruption of vesicles, it reduces the condition of the patient to a remarkable degree and often yields only to large doses of narcotics. The pruritus, which is extremely violent in some cases, is very annoying and intractable.

A. Cazenave has described a peculiar form of pemphigus which he calls foliaceus. At first we find a few, usually small flaccid vesicles, with purulent contents, which become more numerous after the lapse of months. After a short period, the vesicles discharge their contents; occasionally not even vesicles are formed, and the skin is raised up in larger or smaller shreds of a yellowish or grayish color, which roll in from the free side. A new-formation of vesicles and separation of the skin form under these scales or crusts, and the morbid products are thus collected into "rolled, dough-like" structures, and the patient looks as if the skin had become converted into shreds. Not infrequently, scarcely a healthy spot can be found in the entire body: here an eroded, somewhat moist or suppurating spot, the shape of which indicates the circular form of the previous vesicle, there accumulations of scales; here crusts, there numerous flaccid vesicles; entire regions of the skin look as if scalded, and adhere readily to the bed-covering; the hair of the scalp and beard falls out, the conjunctiva is injected, the lower lid often slightly ectropic. Emaciation sets in, the absorption of pus causes an occasional rise of temperature. At times there are symptoms on the part of the intestinal tract. Death closes the scene after a shorter or longer period.

The buccal and pharyngeal mucous membranes and the conjunctivæ do not remain unaffected by the formation of vesicles. When they develop on the epiglottis and mucous membrane of the larynx, the most threatening symptoms of suffocation may be produced.

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[1] Prag. med. Wochenschr., Bd. iii., S. 6.

Very rarely the vesicles occur upon the mucous membrane of the nose or the female genitalia. In rare cases, they develop earlier upon the mucous membranes than upon the integument.

v. Baerensprung[1] first observed hypertrophy of the sebaceous glands as a sequel of pemphigus. In like manner, it may be followed by an enormous development of furuncles.

*Etiology.*—The causes of pemphigus are unknown. It occurs not infrequently in vigorous individuals, and cachectic symptoms do not appear until the disease has lasted for a long time.

In a case in which the clinical diagnosis of herpes iris (pemphigus?) was made, and which terminated fatally, with acute decubitus over the sacrum and inflammation of the lungs, Jarisch[2] discovered anatomical changes in the spinal cord. He found macroscopic changes in various parts of the gray axis, particularly in the central, lateral, and posterior portions of the anterior horns. The changes consisted of inflammatory appearances of the ganglion-cells (swelling of the processes of the cells) and the fibrous interstitial substance. Dejerine[3] and Leloir found changes in the peripheral nerves in pemphigus, the fibres being degenerated in the vicinity of fresh vesicles, while empty sheaths, with increased nuclei, alone remained underneath old vesicles.

Vesicles often appear upon the anæsthetic spots of leprosy, in which the nerves have undergone anatomical changes.

We may regard as reflex those cases of pemphigus which are produced by changes in the genital organs, particularly of women, such as the cases of recurring pemphigus in pregnancy, and the pemphigus hystericus (Hardy) of uterine anomalies. In a child Startin observed vesicles upon the arms and legs as the result of round worms, and the former disappeared after the discharge of the worms. Kœbner[4] calls attention to the similarity of pemphigus to herpes and urticaria and assumes an irritation of the vaso-motor nerves and a certain predisposition of the skin as the cause of pemphigus. v. Baerensprung[5] believes that it is a primary affection of the blood, like the exanthematic processes, and that the blood is not affected in its entire mass, but only in certain vascular districts. The assumption of a toxic origin is made when the vesicles follow septic processes, surgical measures, puerperal processes, ulcerative endocarditis, uræmic poisoning after scarlatina, after the administration of certain drugs (arsenic, iodide of potassium, bromide of potassium, salicylate of soda).

Purulent vesicles not infrequently occur repeatedly upon the lower limbs of enfeebled individuals, who are bed-ridden from some other disease.

*Anatomy.*—The formation of the vesicles occurs by the separation of the stratum granulosum from the stratum lucidum. When they have attained a certain size, they contain no meshes and have a single chamber; occasionally there are nipple-like projections from the inferior surface of the roof of the vesicles, corresponding to the epithelium cells discharged from the follicles.

The contents of the vesicles vary greatly, containing serum, pus, and epithelium cells. Jarisch[6] found its specific gravity 1.0196, water 941.9 parts, solid matters 58.1

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[1] Ann. d. Charité, Vol. x., p. 101.

[2] Sitzungen d. k. k. Akad. d. Wissensch., III. Abth., Bd. 81. Mai, 1880.

[3] Gaz. d. Hôp., 1876, p. 835. In a paralytic old woman.

[4] Arch. f. Dermat., 1869, S. 218.

[5] Ann. d. Charité, Vol. x., p. 99.

[6] Sitzungsber. d. k. k. Akad., Abth. III., 1879, S. 59.

parts; it contained serum albumin, paraglobulin, and a little fat. The ashes contained chlorine, sulphuric acid, phosphoric acid, carbonic acid, potash, soda, oxide of calcium, oxide of magnesium. in all 0.84% ashes. Urea and fat were also present, but no free ammonia.

The rete cells which form the floor of the vesicle are flattened in their upper layers, the nuclei being retained; the papillæ show vascular injection, the vessels are somewhat dilated, the connective-tissue network is looser. In pemphigus foliaceus Neumann [1] found the connective-tissue bundles of the cutis thickened, the rete cells clouded by finely granular masses, the sweat-glands enlarged and filled with necrotic cells, their excretory ducts dilated, the horny layer imperfect.

Tubercular changes were found in the other organs in fatal cases and also chronic degeneration of the kidneys, waxy degeneration, pneumonia.

*Diagnosis.*—The contagious pemphigus of the new-born and children must be distinguished from, 1, the ordinary, non-contagious form, which occurs in children, though more rarely; 2, syphilitic pemphigus, which is confined chiefly to the palms of the hand and soles of the feet; the vesicles are usually purulent, the skin presents a brownish-red infiltration upon which the vesicles have formed, or there is merely separation of the skin upon an elevated base. Other specific symptoms (coryza, exanthems, anæmia) are usually present.

We must be on our guard against simulation, for which purpose cantharides is hiefly employed. The shining scales of the Spanish fly which can be detected upon the wall of the vesicle and its vicinity, are indubitable evidences of simulation.

The superficial position of the vesicles, their recovery without cicatrices, with a smooth pigmented skin, the never-failing relapses distinguish chronic pemphigus from the specific ulcerative processes associated with the formation of vesicles or large pustules.

The general condition of the patient must always be taken into consideration in making a prognosis. The occurrence of typhoid symptoms with abundant formation of vesicles is of very unfavorable significance, both in the acute and chronic forms of pemphigus.

*Treatment.*—Acute contagious pemphigus neonatorum requires isolation, the greatest cleanliness, good nourishment, the prevention of disturbances on the part of the intestinal tract, the application of powdered substances, lukewarm baths. Acute simple or contagious pemphigus requires, according to the severity of the general disturbances, merely symptomatic treatment with quinine, roborants, etc. Locally we may apply powdered hygroscopic substances and bandages with ointments.

The most important indications in chronic pemphigus are, 1, to keep the nutrition of the patient in the best possible condition; 2, to relieve the annoyances caused by the vesicles, by the use of bandages, the water-bed, dusting powder, etc.; 3, to prevent septic complications from absorption of purulent substances from the vesicles by cautiously opening them; 4, to prevent inanition if the mouth is affected. The first indication is fulfilled by the administration of tonics and bitters, such as iron, quinine, etc., nourishing diet, wine, and, if the mouth is affected to a marked extent, even feeding by the ectum.

Hutchinson [2] has observed entire recovery in several cases of pemphigus after treat-

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[1] "Lehrb. d. Hautkrankh.," V. Aufl., S. 243.

[2] Med. Times and Gazette, 1875, Vol. ii., p. 461.

ment with arsenic. Devergie recommended ferr. sesquichloratum, 6–8 drops t. i. d., in sugar water, v. Baerensprung the internal application of chlorate of potash. With regard to the second indication, many authors emphasize the injurious effects of baths, while Hebra employed water advantageously in various ways, such as cold douches and baths, hydropathic packs, a water-bed (*i. e.*, constant stay in water of the temperature desired). Devergie and Hebra also recommended baths with corrosive sublimate, 4.0–10.0 per bath, with caustic potash, 50.0, with carbonate of soda, 100.0–150.0; also the application of the oil of cade and a subsequent prolonged bath. Hillairet recommended linimentum calcareo-oleosum and the application of cotton, *i. e.*, the same treatment as in burns. In other cases, the application of dry dusting-powders is sufficient. Disinfecting or astringent gargles may be used profitably to meet the fourth indication.

## CHEIROPOMPHOLYX.

Under this name, J. Hutchinson described a disease the severer forms of which occur chiefly in women. It begins with itching and burning in the fingers, and in a few (two) days vesicles develop rapidly and symmetrically in the integument of the fingers and vola manus, looking like swollen grains of sago. Larger vesicles are also present. The feet are often affected in the same manner, but usually somewhat later than the hands. A temporary erythematous eruption (rash) and pruritus occasionally develop over the body at the same time. The vesicles form without any inflammatory symptoms, and their contents disappear in a short time. The disease is followed at times by a peculiar change in the nails;[1] they are undermined and break in the vicinity of the root. Relapses always occur in this affection. It occurs almost exclusively in adults, particularly in nervous individuals,[2] but sometimes in vigorous persons, during and after protracted mental activity. The contents of the vesicles at first are neutral, later acid; sulphuric acid produces a whitish precipitate.

*Anatomy.*—Robinson[3] gives the following description of the microscopical appearances. The collection of serum takes place between the upper layers of the rete Malphighi (stratum granulosum?), and the rete-cells forming the floor of the vesicle are flattened, in places elongated. The roof of the vesicle, formed of rete-cells, has a variable thickness. There are no changes in the papillary vessels. The formation of the vesicles corresponds to the arrangement of the papillæ; the smallest vesicles coalesce into larger ones by the atrophy of the intervening cellular wall. The clear fluid con-

[1] Thin, British Med. Journ., Dec., 1877. Liveing, ibid.

[2] The following must be regarded as abnormal cases of cheiropompholyx: A woman sufferlng from nervous hemicrania was affected with lancinating pains in the inner side of the right middle finger. A large vesicle soon developed, followed by several relapses in the same place (Behse, Petersb. Med. Ztg., 1869, Bd. x., S. 321). Rendu (Ann. de Dermat., Vol. vi., p. 201, Obs. 34) reports the following case: A woman is affected from time to time with chilliness, malaise, temp. 39–40°, at intervals of one to two weeks. After the fever, marked redness develops in the hands and lower limbs, with tension, throbbing, sensitiveness, and burning, as in erysipelas. General diaphoresis occurs during the painful œdema. Soon afterwards, vesicles of various sizes, arranged chiefly in groups, appear symmetrically upon the palm of the hand, sides of the fingers, the lower limb, and inner side of the foot; they are filled at first with serous, later with purulent contents. They persist for two to three days; then the skin becomes pale, crusts form, and marked desquamation. Lymphangitis occasionally develops later, sometimes with suppuration of the glands.

[3] Arch. of Derm., Vol. iii., p. 291.

tents are rendered opaque, at a later period, by an increasing number of round cells, the papillary vessels become dilated, and a round-cell infiltration occurs in the papillæ. The layer of horny cells becomes macerated, although the roof of the vesicle does not burst, and insensible evaporation of the contents thus occurs. The rete layers on the floor of the vesicle are also infiltrated with round cells in the later stages. There is no change in the subcutaneous connective tissue or the sweat-glands. These appearances combat the term dyshidrosis chosen by T. Fox for this affection. T. Fox and R. Crocker[1] found dilatation and marked sinuosity of the excretory ducts of the sweat-glands; the vesicles formed in the papillary layer of the rete, and here and there were connected with the sweat-glands; the vesicular contents consisted of granular and cellular masses. In some places, the coils of sweat-glands were enlarged.

*Diagnosis.*—Hebra regarded this disease as a vesicular eczema, but it is distinguised from this disease by its restriction to the parts mentioned, and by the relapses and more marked nervous phenomena.

*Treatment.*—As the disease recovers spontaneously, symptomatic treatment of the pruritus is alone indicated.

## IMPETIGO HERPETIFORMIS (HEBRA). HERPES GESTATIONIS.

The disease described by Hebra as impetigo herpetiformis belongs to the series of pemphigoid affections, as a connecting link between acute pemphigus and the chronic form (pemphigus foliaceus). Hitherto it has been observed exclusively in women during pregnancy.

Milton[2] reports a case in which during several pregnancies (in the fourth month) bright-red, slightly elevated plaques, from the size of a pea to a walnut, appeared upon the inner side of the arm; pointed vesicles, usually in groups of two to four, were often situated upon the patches. The violent pruritus gave rise to insomnia. The contents of the vesicles soon became cloudy, and the affection rapidly extended over the trunk and the other limbs; general malaise and great irritability were also present. Premature delivery occurred during the sixth month. New pustular eruptions developed after delivery, but complete recovery occurred soon afterwards. E. Wilson[3] reported a similar case.

H. Auspitz[4] described a fatal case under the term herpes vegetans, because here, as in certain cases of pemphigus, papillomatous proliferations formed in some of the affected spots. J. Neumann published a similar case, but without any proliferation, under the name herpes pyæmicus. Hebra[5] applied to the disease the term impetigo herpetiformis, on account of the clinical appearances. Pustules develop in bunches, occasionally vesicles with contents which become cloudy; these become incrusted. Under the desquamated crust the skin appears reddened, destitute of its horny layer, shining, occasionally moist, but never ulcerated; secondarily, the tense, somewhat infiltrated skin may fissure in various places, especially around the joints. By the development of new groups of pustules upon other parts of the body, and the extension of the pustular process in the neighborhood of a group already present, the affection spreads over the larger part of

[1] Med. Times and Gazette, 1878, T. i., p. 632.

[2] Journ. of Cutan. Med., Vol. i., p. 311.

[3] "Skin Diseases," 6th ed., p. 294.

[4] Arch. f. Derm., 1869, S. 246.

[5] Wien. med. Wochenschr., 1872, No. 48; and "Lehrbuch," II. Aufl., Bd. i., S. 654.

the integument, especially the anterior surface of the thorax, the abdomen, and thighs. No part of the integument escapes, even the buccal mucous membrane may be affected.

The hair and nails often fall out during the course of the morbid process. Extensive pustular eruptions begin with a chill, often considerable increase of temperature, insomnia, restlessness, etc., as in a septic affection.

If the pregnancy has reached its normal or premature termination by delivery, the disease, as a rule, does not stop at the same time. In the majority of cases observed in Vienna, the disease terminated fatally. I saw one case end in recovery, several weeks after delivery.

The mildest form of this usually finely-vesicular pemphigus gravidarum is that described by D. Bulkley[1] as herpes gestationis, and by Smith[2] as hydroa gestationis. It occurs usually in the latter part of pregnancy, with violent pruritus and pains; red patches and papules appear, upon which vesicles, often of considerable size, are arranged in groups, at first upon the limbs, later over the entire body. The general condition of the patient is tolerable. The disease returns ordinarily in subsequent pregnancies.

*Anatomy.*—Neumann[3] has observed considerable dilatation of the vessels, particularly the veins and lymphatics; an abundant infiltration of round cells is present in the cutis, and the cells of the sweat-glands are increased in number.

*Etiology.*—The more intimate internal relations of this variety of pemphigus are as little known as those of pemphigus in general. The prognosis varies greatly according to the extension of the disease, the febrile symptoms, the various grades of the exudative process, whether small or large vesicles or pustules, the more rapid or slow loss of vitality.

I have seen a case of impetigo herpet. mistaken for a general pustular eczema.

*Treatment.*—The disease is affected very little by therapeutics, and the internal treatment is merely symptomatic and roborant, according to ordinary general indications. External treatment is directed against the accumulation of pus underneath the crusts by means of ointments, protracted and permanent baths; against the pruritus, by tar, liquor picis alkalini, Bulkley (pic. liq., 8.0; kali caust., 4.0; aq. 20.0; one teaspoonful to about 100.0–150.0 of water), belladonna, opium, and hydrate of chloral ointments, etc.

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[1] Amer. Journ. of Obstetrics and Diseases of Women, Vol. IV., No. 4.

[2] Dubl. Med. Journ., 1881.

[3] "Hautkrankheiten," V. Aufl., S. 267.

# CHRONIC INFECTIOUS DISEASES OF THE SKIN.

BY

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## GENERAL INTRODUCTORY REMARKS.

Chronic infectious diseases comprise a group of affections the origin and course of which are dependent upon organized infectious matters which reproduce themselves within the body. These infectious matters have as their common and chief characteristic a generally *slow* power of increase in the human organism, thus rendering the *typical course of these affections a pronouncedly chronic one.* Their effect manifests itself in inflammatory processes which subsequently, under the specific influences of the virus, have a course and termination specific of each disease ; thus these chronic inflammatory processes finally represent new formations ("tumors") which, owing to their peculiar course, have long been separated as a special family of diseases.

This class comprises, besides the diseases of the skin with which we are specially concerned, viz.—

1. *Tuberculosis.*
   - *a.* Miliary tuberculosis of the skin.
   - *b.* Scrofuloderma, to which I add
   - *c.* Lupus vulgaris.
2. *Lepra.*
3. *Syphilis.*
4. *Mycosis fungoides* (Alibert).
5. *Frambœsia tropica* s. Polypapilloma tropicum (Charlouis)—the following diseases, which we shall have to refer to at some points for the elucidation of contested questions. They are :
6. *Glanders.*
7. *Actinomycosis* which, discovered by Bollinger in animals, has also been recognized as a disease of the human species.
8. *Lymphosarcoma,* which has been recently included by Cohnheim among the granulation tumors on an infectious basis.

9. *Trachoma*, which, as has been already indicated by Virchow, must obtain its place in this class.

10. Also the proliferations occurring in parasitic sycosis, in kerion Celsi, and those in diabetic forms of balanitis (perhaps also the Madura foot, the *Aleppo bubo*, and kindred diseases) are by right to be incorporated into this group of diseases, because they represent granulation tumors due to parasites (mycelia).

The name "granulation tumors" has been applied by Virchow to this group of tumors on account of their resemblance to the cell masses of inflammatory granulations. In all these forms it is mainly, but not exclusively, the connective tissue and similar parts from which the new development arises. It usually ends in the development of numerous, generally small round cells with, as a rule, comparatively large nuclei; they bear a certain resemblance to the so-called lymph-cells. Virchow proposed for them the name "*granuloma*."

The main question at issue—whence do the cellular elements of the neoplasms arise?—is still the object of spirited controversy. Beside Virchow's old doctrine, that the cells are derivates of the fixed tissue elements, that of Cohnheim, relative to the origin of inflammatory cells from emigrated white blood-corpuscles, has gained adherents also in explanation of these tumor cells; we likewise hold it to be most probable that the cells of granulation tumors are essentially white blood and lymph corpuscles which, after inflammatory alteration of the vessel walls, have emigrated and now form the material for the further growth of the tumors.

But a striking advance has been effected by the *elucidation of the etiological factor*. To Virchow the etiology was not the fundamental point in the consideration of the structures under discussion. The idea of "infectiousness" for the majority of the affections was superadded subsequent to Virchow. Thus it was Klebs who created the name "infection tumors" for granulomata; Cohnheim (p. 704) accepted it; Ziegler united the histological and etiological parts in his designation, "infectious granulation tumors." We are fully justified in designating this group as chronic infectious diseases in view of the finding of bacteria and other fungi in tuberculosis, leprosy, actinomycosis, glanders. We prefer the latter title, as a class name, to the above-mentioned "infection tumors," etc., because the "character of tumors" is frequently absent in the pathological process; ulcerations, and inflammations of acute course, manifest themselves in the various stages of the affection, for instance, in some forms of syphilis, in actinomycosis, etc.

It requires no special emphasis that the idea of infectious, does not coincide with that of contagious diseases.

To be sure, the view here expressed is not as yet demonstrable in all points and for every single disease. But it conforms more to anatomical and clinical experience, and is much better supported than any other attempt at explanation.

I am inclined to believe that, even for the purpose of a text-book the understanding will be better served by a harmonious standpoint than by a sceptical separate consideration, even if justified in itself.

The classification of Hebra-Kaposi rests on purely clinical principles and describes lupus under "cellular new-formations" (Cl. VIII.); leprosy, carcinoma, sarcoma, under "malignant new-formations" (Cl. IX.); finally hard chancre in Cl. X., "cutaneous ulcers" or "ulcers due to specific inflammation." This is really no classification, but merely a juxtaposition according to comparatively external factors.

Nor can we concur fully with the system erected by Auspitz, although essentially it agrees totally with ours.

His Class VIII., chorioblastoses (anomalies of growth of the corium and the subcutaneous connective tissue of the skin) contains, under B, paratypical growth, etc., paradesmoses, all the affections intended to be discussed in this chapter.

But if we enter more fully into the principles on which this classification is based, we shall have to ask ourselves how the above system could be erected: for instance, how (without regard to the etiology) lepra maculosa and anæsthetica, in which there is no mention of "granulomas of the skin," comes to be placed by the side of lepra tuberculosa. For as a matter of fact, Auspitz starts "from the point of view that in this class the granular infiltration, in the above-mentioned sense (*i. e.*, granuloma formation), constitutes the essential feature of the process." Despite this *anatomical* standpoint, he furthermore united in this class all *anatomically different* processes incited by syphilis, thus putting the *etiological* conception of disease quite into the foreground. It would require a detailed explanation that we must also protest against the intention to designate by the name "lupus" (already current for a "disease") all granulomas of the skin, that hence we could not agree with his view of a lupus scrofulosis, lupus syphiliticus (lupus leprosus, according to the Spanish school), were it not that Auspitz himself adheres with obvious tenacity to-day to this formerly advanced view.

Against this view Kaposi already had raised objections from clinical standpoints, indicating the differences in appearance, course, spread, treatment, etc., between the ulcerous syphilide and the genuine lupus. Even if we admit that the differential diagnosis is often very difficult, perhaps momentarily impossible, still such temporary embarrassment is not in itself ground sufficient to place so near to each other totally different morbid processes. For they are truly different morbid processes, even if in both affections the *first* anatomical stage is represented by heaps of granulation cells. We have accepted the class name "granulation tumors" only on the ground of the *development* of these cellular tumors which all *spring from* the same material (granulation cells). For as regards the *further* anatomical relations we are forced to differ from Auspitz when he says: "The histological examination of these new-formations has not been able hitherto to demonstrate a thorough difference between the several forms." Of course, this is true for the *first* stages of the tumor formation in which the similar cells, derived from the same source, are still undeveloped; it agrees also with some of the *terminal forms* with their altogether similar necrotic masses (tuberculous cheese and gumma detritus). In the *intermediate stages*, however, the microscopic-histological differential diagnosis (even without regard to the micro-organisms) between tuberculous, syphilitic, and leprous products is seldom attended with difficulties. And what at times does not succeed with the microscope can often be decided with certainty by macroscopic inspection.

*But the most important factor* is the *etiological* difference. *Syphilis has a specific virus, so has leprosy, and also tuberculosis.* Therefore, the diseases produced by them have nothing in common, even if the most conspicuous resemblances appear in their products.

Lupus we interpret as a form of the tuberculous infection.

It may be an inconsistency on our part to retain the name "lupus," instead of saying "tuberculo-derma." But the name lupus is so firmly established and so little liable to lead to misunderstanding that we may retain it. For us, lupus is a *tuberculosis* of the skin; it is erroneous, therefore, to speak of a lupus syphiliticus; all the more because this term offers no advantages, very frequently leads to mistakes, and is directly opposed to the principles now prevailing in dermatology.

Our next task is divided into two parts. First, we must demonstrate the mycotic character of these diseases, on the one hand by the microscopic proof of organisms in the new-formations which may be called the inciters of infection, on the other by the experimental demonstration that by the inoculation of its organisms the disease may be reproduced at will in the animal body. In the case of tuberculosis we are indeed able to fulfil this requirement in its entirety; in leprosy we know the parasite, but there is no final proof of its pathogenetic effect—cultivation outside of the animal body and successful inoculation of a healthy organism. In a third group (syphilis, glanders, frambœsia) we

shall have to be content with the demonstration that the symptomatology bears the character of a parasitic infectious disease.

As it is not possible to discuss all the questions belonging here in connection for all diseases, I have brought them together in each affection under the head of "General Pathology."

The second part of our task will consist in tracing the connection of the local new-formation with the pathogenetic parasite. This requisite, I believe, it will be possible to fulfil exactly as regards the leprous disease. In general, the following axioms may be maintained: The local effects caused by the immigrated bacteria may be traced back to two factors, which indeed are very changeable in their importance for the pathological process in the several affections; now one, now the other preponderating, perhaps also one not becoming obvious at all. *But in every case the final product, the effect, for every species of bacteria is a specific one; the pathological processes in themselves have absolutely no specific character.*

1. One of the above-mentioned factors is an alteration of the vessel walls of the blood and lymph channels, especially the lymph sheaths inclosing the large vessels, leading to inflammation. Lymph-cells, white blood-corpuscles accumulate in the tissue, to serve, in their further stages of development, in the building up of the tumor. The process of cell production in itself, therefore, is not specific, and hence we cannot speak of a "specific inflammation." *But the future destination of the cells furnished by the vessels, which serve as the raw material, is specific for every form of disease and directly dependent upon the specific qualities of the respective virus.* There comes in question here, first, the acuteness of the inflammatory cell production and its relation to the vascular development which may proceed in more or less adequate proportion; second, especially the direct, immediate influence on the several cells exerted by the immigrated bacteria. These modify the normal course of the inflammatory connective-tissue development in a specific manner, so that either an intermediate stage of the progressive cell development is maintained for a very long time, or specific degenerative processes run their course in the cells.

2. The virus acts not only on the vessel walls, inciting inflammation, but the tissue itself is implicated. Our knowledge of these "tissue processes" is still very slight, and relates in but a few points to the vascular connective tissue. Of the nerves, muscles, and glands we know only that they have perished in certain stages. Only in a single case (formation of the primary induration in syphilis) we shall have to speak of *productive* implication of the fixed connective-tissue cells. (The "granulation cells" we trace back, as above stated, to inflammatory lymphoid cells.) Otherwise we have to deal only with *necrobiotic* processes which are excited by the virus at an earlier or later period, in the connective tissue and its vessels.

There is no "specific" implication of the epithelium. Although the latter is frequently—especially in the initial stages—found very largely increased, it furnishes no characteristic signs of the respective granulation-cell tumor.

Thus we have to deal essentially with an inflammatory process in the connective tissue. The course of this inflammatory process, however, is an abnormal one by the influence of these very parasitical formations. It does not lead to new formation of connective tissue—but, whether by an alteration suffered at any time by the cell material itself or by the vascular development requisite for the nutrition of the cellular neoplasm, sooner or later the "tumor" perishes by the same organisms which have caused it.

The acuteness and the malignancy of this process depend directly upon the qualities of the instigators of the infection.

According to the infectious materials, we distinguish the following groups.

1. Tuberculosis.
2. Leprosy.
3. Syphilis.
4. Frambœsia tropica.
5. Glanders.
6. Actinomycosis.

As regards mycosis fungoides, we lack as yet every landmark on which to base the assumption of an infectious disease; according to its structure and its clinical course, it decidedly belongs to our class.

On the other hand, I certainly hold that lupus erythematosus does not belong to this group. The inflammatory cellular infiltrations occurring in it are inconstant, and at any rate do not form the essential feature of the pathological process; perhaps lupus erythematosus, like psoriasis, belongs to the epithelial affections.

## I. TUBERCULOSIS, SCROFULOSIS, LUPUS.

General Pathology.—At the present time, tuberculosis, and with it scrofulosis, is the best-known chronic infectious disease of man, and the only one demonstrated with certainty.

Villemin was the first to class tuberculosis as an inoculable infectious disease; but his doctrine failed to secure universal recognition. Further inoculation experiments were made by different savants in the most variable manner. The experimenters introduced the material into the animals from all possible points, so that the following result was rendered certain. If tuberculous material be transferred to an (appropriate) organism, there is developed in it, in a typical manner, a tuberculosis which sometimes remains more local, at other times spreads through the body generally. Only specific tuberculous material is capable of communicating this disease. Non-tuberculous matters, or those deprived of their infectious quality, *never* produce tuberculosis. It was shown at the same time that the "predisposition" of some classes of animals was variable as regards the receptivity for the disease.

Klebs described a form of micrococcus as peculiar to tuberculosis and cultivated it. In the same way, Schüller has reported experiments in cultivation and inoculations with its result. A landmark has been furnished also by the interesting experiments made by Deutschmann, who, by leaving at rest inoculable tuberculous pus, separated it into a light wine-yellow serum inactive in inoculation, and a thick, tenacious sediment which produced tubercle. Recently, Damsch, in Ebstein's clinic, has been able to demonstrate tuberculosis of the urinary passages in the living, by successful inoculations into the anterior chamber of the eye of rabbits. Aufrecht alone has described microscopically specific bacteria in the tissues, without having been able to gain general recognition of his results.

But the credit of having finally elucidated the nature of tuberculosis belongs to Robert Koch, who furnished the incontrovertible proof that *a specific bacillus is the cause of tuberculosis and of scrofulosis.*

The proof consisted, first, *in the demonstration of a parasitic micro-organism in tuberculous neoplasms.* For this a new staining process had to be invented which culminated chiefly in the fact that alkaline solutions were alone appropriate. The method originally devised by Koch was very soon modified by Ehrlich, who found the alkalescence-producing factor in anilin oil (or, according to Ziehl, in carbolic acid). His procedure is as follows: The sections, or else the dry preparations made on covering glass and suf-

ficiently warmed, are stained in a mixture produced by the addition of a concentrated alcoholic fuchsin or gentiana-violet solution to a watery, well-agitated and filtered aqueous solution of anilin oil (carbolic acid solution). In this the preparations are left for a *long* time, *best several hours*, or a short time in *heated* solutions, are then freed from superfluous color in alcohol or water, and are then immersed in a solution of one part of officinal sulphuric (or nitric) acid with two or three parts of distilled water. The deep blue (or red) color gives place at once to a faint yellow, the stain being bleached in all parts of the tissue. *The bacilli, however, retain the color and may now be recognized under comparatively low power* (Hartnack obj. 7). It is better to subsequently stain the background with anilin brown or methylene blue, because then the blue or red bacilli can be more easily distinguished. The preparations, after having been dehydrated in alcohol, are rendered transparent in oil of cloves and preserved in Canada balsam. The preparations are not always permanent, the color of the bacilli gradually fading, probably because the acid is not thoroughly washed out. The gentian preparations are certainly more constant in their color than the fuchsin preparations. The color keeps best when the specimens (dry preparations) are not at all inclosed in Canada balsam, but are directly examined in oil of cedar (with homogeneous immersion).

The bacteria rendered visible by this method have a rod shape, hence are bacilli. Their length corresponds about to one-fourth to one-half the diameter of a red blood-corpuscle. Their breadth differs according to the method employed; Koch's original methylene blue renders apparent only the exceedingly slender bacilli, while Ehrlich's and Baumgarten's staining processes color also the sheath inclosing the bacillus. Characteristic of the tubercle bacilli, in Koch's older method, is their rejection of the anilin brown staining after they have already taken the methylene blue. In Ehrlich's method, the tubercle bacilli retain the tint present in the anilin oil and are not decolored by acid or subsequent methylene blue staining.

The bacilli are found in great numbers *wherever the tuberculous process is of recent inception and in rapid progress;* then they usually form closely packed small groups often arranged in bundles which lie largely *within* the cells. Besides, there are also numerous free bacilli; especially at the border of large cheesy patches they are present in large free swarms. After the acme of the tubercular eruption has been passed, the bacilli become sparser and can be seen only isolated, often as faintly colored, probably dying or dead formations. If giant-cells are present, the bacilli are found most numerously within them. Here, too, those with bacilli are the more recent, those without them the older cells in which the bacilli originally present have died or have passed into a subsequent dormant state. Besides the ordinary bacillus forms, we find others with two to four oval spores which are placed at regular intervals along the bacillus.

Subsequent examinations, wherever made, confirmed the correctness of Koch's statement as to the constant presence and the diagnostic value of these bacilli in tuberculous affections.

But even this did not satisfy Koch himself. He said: "It does not follow, however, from this coincidence of tuberculous affection with bacilli that both phenomena stand in causal relation to each other, though no slight degree of probability for this assumption is furnished by the fact that the bacilli are found chiefly wherever the tuberculous process is in its inception or progress, disappearing where the disease comes to a standstill." "*In order to prove that tuberculosis is a parasitic disease caused by the immigration of the bacilli and is originally due to their growth and increase, the bacilli must be isolated from the body and cultivated in pure fluids until they are freed from*

*any possibly still adhering morbid product derived from the animal organism, and finally, by the introduction of the isolated bacilli into animals, the same morbid picture of tuberculosis must be produced which experience has shown us to result from inoculation with tuberculous matters of natural origin."*

This task Koch has performed in a brilliant and absolutely unobjectionable manner (despite Spina's demurrer).

The cultivations were made in sterilized, coagulated blood serum. They were distinguished by an exceedingly slow growth which proceeds only at a temperature of 37–38° C.; they form minute compact scales which can be easily detached in toto and by appropriate examination are shown to consist only of the well-known, extremely delicate bacilli. The cultivations yielded corresponding results, whether the matter was derived from animal or human tuberculosis; they were continued for months outside of the animal body, by successive transference from serum to serum.

But in every case inoculations of healthy animals with the cultivations yielded a positive and constantly uniform result—a typical inoculation tuberculosis of the animal.

In guinea-pigs the inguinal glands swelled after two weeks, the points of inoculation on the abdomen changed into an ulcer, and the animals emaciated. After from thirty-two to thirty-five days the animals were killed. They all exhibited intense tuberculosis of the spleen, liver and lungs; the inguinal glands were greatly swollen and cheesy, the bronchial glands were only slightly swollen.

In the same way rabbits, rats, cats, dogs, etc., were successfully inoculated. The experiments with rats and dogs are especially interesting because these animals have otherwise shown themselves uncommonly resistant toward inoculations of tuberculosis.

The result of the experiments is independent of the point of inoculation: subcutaneous connective tissue, anterior chamber of the eye, abdominal cavity, direct introduction into the blood current, etc. Only it is necessary, owing to their exceedingly slow growth, that the infectious matters be brought to a spot where, protected from external injury, the bacilli have the opportunity to increase and penetrate into the tissues, otherwise the bacilli are again eliminated before they secure a habitat. "Small shallow cutaneous incisions are no wounds appropriate to the invasion of bacteria. Similar conditions will be requisite to insure the adherence of the bacilli which have reached the lungs. Probably, factors favorable to the retention of the bacilli, such as stagnating secretions, denudation of the mucosa of its protective epithelium, etc., will be of assistance in effecting the infection."

It appeared, furthermore, that the rapidity of the course of inoculated tuberculosis, as well as its extent and spread over the several organs, is dependent upon the larger or smaller quantity of infectious matter introduced. The picture of acute miliary tuberculosis occurred only when the body was at once overwhelmed, as it were, by a large quantity of infectious germs. Otherwise, when but few bacilli are inoculated, the processes are of slow development or circumscribed locally (nodules on the iris, opacity of the cornea, affections of the lymphatic glands), which are very much later succeeded by general inflection, unless the disease terminates altogether with the local processes.

There remains to us the task of maintaining for our limited field the principal points, as well as isolated experiences to be utilized by their analogy with lepra, syphilis, etc. They are:

1. Tuberculosis—*i. e.*, that disease of sometimes acute, sometimes chronic course, attended with the formation of small granulomata—arises from the infection with a specific kind of bacteria, the above-described bacilli.

2. The parasites transmitting the infection are always derived from an animal organism, and are transferred more or less directly from one organism to another. Outside of the animal body, the bacilli or their spores may retain their infectious character for a time; but they cannot multiply outside the animal body (except under conditions for special culture), like the bacillus anthracis.

3. For infection, the bacillus requires undisturbed development at a protected place. On the skin and the mucous membranes, a lesion of the protective epithelial covering is an indispensable prerequisite. The delicate endothelial covering of the pulmonary alveoli, with the larger openings of the lymph-channels between the cells, and also the surface of the iris, seem to permit entry of the bacilli into the plasmatic channels without mechanical lesions. The local process at the point of infection ("primary effect"), according to observations hitherto made, is the following:

After an incubation of from eight to fourteen days, a nodule forms at the point of inoculation, which either increases without rupturing or, generally, changes into a shallow dry ulcer. Very soon (often simultaneously, it appears) the neighboring lymphatic glands swell, and then already, as a sign of the constitutional affection, appears the great emaciation leading in two more weeks to rapid death.

No certain deductions can unfortunately be drawn at present as to the relation of the local infection to the general disease, especially as to the precise time when the latter commences, and whether the latter depends upon a local tuberculosis at the point of inoculation. Noteworthy is the almost synchronous affection at the point of inoculation and that of the neighboring lymph-glands, which is succeeded by the general eruption in the other organs; here again there is a regular anatomical connection between the last-attacked organs and the formerly affected lymphatic glands.

4. The acuteness of the development and the course of tuberculosis are dependent mainly upon the quantity of the infectious material introduced each time. A greater resistance peculiar to some classes of animals (rats, dogs) is second in importance, but is not absolute, and is overcome by inoculations with cultivated bacilli, that is, large quantities of them.

5. The question whether tuberculosis continues to spread by heredity is still *sub judice*. Theoretically, the possibility that the bacilli migrate from the maternal into the fœtal organism, or that a direct bacterial infection of the ovule or the semen occurs, must at once be admitted in analogy with other infectious diseases (syphilis, relapsing fever, the corpuscular disease of silk-worms); nor is this heredity very rare, if we follow Baumgarten, the most recent author on this question. He pointed out that processes now recognized as tuberculous were not formerly acknowledged as such. Besides, there is the large number of "scrofulous affections which come under observation in the first months of life on the post-mortem table and in the living, and which render their fœtal origin very probable."

In our opinion, this intra-uterine origin does not form the rule. On the contrary, in the great majority of the cases we have to deal with an extra-uterine affection occurring after birth.

This variation, this irregularity in the hereditary transmission, though we cannot understand it at present, finds its analogy in syphilis; also in variola, vaccinia, etc., in which the hereditary infection likewise occurs at times and at others does not.

But how can we explain those frequent observations of tuberculous affections of hereditarily "tainted" persons.

Two modes of explanation are possible: either tuberculosis itself, or a predisposition

to it is transmitted. According to the former view, the phthisical habit would be actual tuberculosis; whether subsequently an active disease develops is said to depend upon external influences which sometimes favor, sometimes prevent the increase and spread of the bacilli. The other party admits the physical habit to be the consequence of tuberculous disease of the parents, a developmental anomaly resulting from it, but not latent, undeveloped tuberculosis. (For instance, this bodily conformation may be transmitted to later generations, but without any tuberculosis.) In order that genuine tuberculosis should develop, a later affection with bacilli must indubitably be superadded.

An individual so constituted is sickly, less resistant to noxious influences, but not tuberculous until infected with tubercle. Only this danger of infection with the bacilli is greater with such "habit" than in healthy persons (as a rabbit is more prone to it than a dog); and a further factor is superadded in that such people of "phthisical habit," *i. e.*, inherited inability of resistance, are usually precisely in the environment which especially increases the possibility of infection—surrounded by tuberculous parents and relatives, that is, centres of infection. Hence it will have to be carefully weighed whether the bulk of the affections hitherto ascribed to heredity should not more correctly be traced to infections within the family.

Baumgarten, however, firmly adheres to the doctrine of heredity. In the first place, he correctly points out that tuberculosis is not only a disease of early and middle age, but also of infancy. "On the contrary, scrofulosis, which must be looked upon as one of the manifestations of tuberculosis, is an almost exclusive privilege of childhood." That from such foci, which remain harmlessly in the body for years, a more acute form of tuberculosis may subsequently result has indeed nothing remarkable in it, to our thinking. But where there is an absence of such symptoms peculiar to tuberculosis, which are plainly perceptible in childhood, Baumgarten will have us assume "latent" foci, an "insidious tuberculosis of hidden organs" existing from earliest infancy, which is derived in the uterus from the parents (in whom the tuberculosis may likewise be "latent"); a view which he endeavors to prove by very copious material. On the other hand, we shall have to take into consideration the fact that a large number of tuberculous affections in infants, formerly considered to be hereditary transmissions, are possibly traceable to infection with the milk of gargety, *i. e.*, tuberculous cows.

We hold, therefore, that hereditary and intra-uterine transmission of tuberculosis is possible, but that the extra-uterine infection with specific bacilli forms the rule.

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Koch's investigations, furthermore, have confirmed what had been taught already by a number of previous attempts at inoculation: That a large proportion of the affections termed scrofulosis (and the pearl disease [garget]) are indeed true tuberculosis. It must be left to further investigation to sift from an etiological point of view the great number of processes which are to-day simply called scrofulosis, often not to be distinguished histologically, and to separate true tuberculous from non-tuberculous affections traceable to other noxa.

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In what manner, under the influence of the bacilli, does the patho-anatomical product arise which we call tubercle?

The tuberculous process is induced by the influence of the immigrating parasites (1)

on the vessels which become inflamed by them and (2) on the tissues which suffer injury in a manner as yet unknown. A localized inflammation is developed which leads to the formation of a nodule consisting of round cells and permeated by the reticulum of the ordinary connective-tissue fibrillæ. Now, while this nodule represents nothing peculiar either in its structure and its cell-forms, or in the manner of its origin (and can be recognized as tuberculous only by the inclosed bacilli), it takes a specific course under the influence of the tuberculous noxa. In the beginning, it enlarges by successive cell accumulation at the periphery, and vessels gradually extend into the mass. But then, *i. e.*, very early, a modification commences at the point of attack of the virus, namely in the centre of each single depot. Not merely the exuding inflammatory cells, but also the tissues deteriorate there; the cellular protoplasm coagulates, the nuclei lose their capacity for staining, *i. e.*, the cells exhibit the typical picture of a necrosis of coagulation (Weigert).

The vessels and the basis substance of this central depot become likewise implicated in the necrosis, and thus is developed that specific form of tissue degeneration which is known as cheesy degeneration (in Weigert's sense) and must be distinguished from inspissated pus deficient in water. Around the cheesy centre are found, however, some progressive developmental forms of the inflammatory round cells: large, bright, epithelioid cells with large nuclei, and those known by the name of Langhans' giant-cells. (These are not situated, as Ziegler assumes, typically in the centre, but rather at the periphery of the tubercle.) Some are inclined to look upon Langhans' giant-cells as exclusively confined to tuberculous processes. Others bring them into relation with the growth of the vessels, interpret them as abortive vascular new-formations, as it were, at the border of the cheesy and still viable cells. With Ziegler, it appears to us at present most probable to look upon the development of the tubercle cells and their various stages (like their origin), not as specific processes, but as developmental forms, such as occur in all inflammatory neoplastic processes, in their further course. Thus it may be that the marginal position of the nuclei stands in a more intimate relation with the specific nature of the tuberculous virus (perhaps also with an incipient necrosis of the central protoplasm of the giant-cell).

Specific in the tubercle is the cause which furnished the cellular material by way of inflammation, and the manner of its destruction: the "caseation" beginning in the centre of each nodule and thence progressing peripherally. A patho-anatomical distinction between specific caseation and other cheesy masses is not always possible. Although tuberculosis always leads to caseation, the latter, inversely, does not in every instance coincide with tuberculosis.

Specific, furthermore, is the subsequent spread of the tuberculous process into the neighborhood. In syphilis or leprosy, "local" recoveries by way of total absorption or inflammatory connective-tissue encapsulation are the rule; in tuberculosis they belong to the rare exceptions. For instance, the typical formation of callosities around gummata is not effected; a small-celled inflammatory zone arises around each tubercle; but the infection extending into it hinders the final, fibrous connective-tissue formation and effects the opposite, progressive caseation, that is to say, the tuberculosis migrates into the tissue. At times, of course, this destructive process is a very slow, insidious one; Baumgarten, too, justly calls attention to the fact that the local malignancy of tuberculosis is greatly overestimated, as we not rarely can demonstrate in the lungs, the lymphatic glands, etc., tuberculosis which has become "latent" at least for years.

The above delineation of the patho-anatomical process has gained some important supports in the discovery of the bacillus.

1. The bacilli are always found in greatest number at the periphery of tuberculous processes.

2. They are largely situated within the cells, especially in giant-cells. But I do not believe that, as Koch assumes, the bacilli are inclosed as foreign bodies in the giant-cells; on the contrary, I think that the immigration of the bacilli into the exudation cells excites the latter to that—atypical—morphological development which we call giant-cells.

3. The bacilli finally lead to the death of the cells, whereby they themselves perish as bacilli, but probably maintain the infectious character of the necrotic masses of tissue by means of the persistent spores.

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In connection with tuberculosis (and scrofulosis) we intend to treat of lupus. It will be our aim, first, to defend the view that lupous disease is a partial manifestation of tuberculosis.

At the outset it should be explained here that I am not able as yet to furnish the exact proof of this connection, inasmuch as the bacilli of tuberculosis have not been demonstrated in lupous material. Schüller has recently published the discovery of micrococci in lupus tissue.

By anilin staining, treatment with acetic acid or potash lye, he discovered micrococci, especially in the smaller and most minute lupus nodules. Between and around the cells the micrococci lie in the form of small roundish granules, but from there penetrate as small rows into the neighboring connective tissue, never as compact masses, but rather loosely and scattered. In the larger, fully developed lupus nodules, micrococci are much more difficult of recognition, owing to the density of the cells. The more recent the lupus formation and the softer the underlying tissue, the more numerous are the cocci, especially at the wall surrounding the larger lupus nodules. To me it appears not impossible that Schüller may have mistaken the granulation of Ehrlich's "mast" cells for hives of micrococci.

However, the demonstration in the tissue of tubercle bacilli, which at best are stained with difficulty, appears to me only a question of time.

Despite careful examinations, no essential histological difference has been found between a caseating miliary tubercle and a lupus nodule. In both formations there is a patch of round cells with epithelioid and giant-cells; there are vessels in the peripheral segments of the nodules; and a central, non-vascular, coagulative-necrotic zone; both have in common the irresistible spread in the tissue and the local relapses.

The resemblance in histological structure between tuberculosis and lupus was first pointed out by Virchow (Onkol., II.), then by Auspitz. Subsequently Friedländer defined lupus directly as a local tuberculosis of the skin. Baumgarten, however, reaches the conclusion that lupus and tuberculosis should be kept apart. Although he considers both as granulation tumors in Virchow's sense, he enumerates the following essential differences:

1. Caseous necrobiosis, always present in tuberculosis, is absent in lupus.

2. The formation of epithelioid cells is less conspicuous in lupus.

3. On the other hand, giant-cells are generally present in such quantity as to form a striking contrast to the sparsity with which they are contained within true tuberculous nodules (of the conjunctiva).

4. We often find vessels in the lupus nodule which are absolutely lacking in tuberculous nodules.

5. In the older portions of the lupus neoplasm we may perceive an increased formation of spindle-shaped elements which increase to such a degree that the entire patch thereby gains the character of recent cicatricial tissue.

6. Furthermore it should be emphasized, in opposition to the essential substratum of conjunctival tuberculosis which always manifests itself in the form of roundish nodules clearly demarcated from the surroundings, that in the products of lupus the miliary structure plays but a subordinate part, and that the lupous infiltrations represent rather the configuration of an irregularly arranged network with thickened nodal points.

7. Finally he claims for the lupus granule the capacity of direct suppuration which is not possessed by tubercle.

With these anatomical differences enumerated by Baumgarten we can concur in general. But, as above pointed out, the fourth paragraph—the non-vascularity of tubercle—must receive some limitation. In the very first stages, tubercle is as free from vessels as the lupus granule. Gradually, however, the formation of vessels is effected in both; but in a higher degree in lupus because in tuberculosis the development is more acutely followed by disintegration. There is merely a difference in degree in reference to the quantity of vessels.

Again, as regards the suppurative capacity of the lupus nodule, it appears to me still doubtful whether at present we can speak of a true primary "suppuration." A cutaneous lupus nodule never changes into a pustule, a lupous ulcer never spreads by acute "suppuration," but slowly in the course of years the marginal portion around the ulcer disintegrates, its infiltration having been microscopically demonstrable long before symptoms of degeneration become externally visible. It is a characteristic of the lupous ulcer rather to form little puriform secretion. What is here called "pus" is nothing but necrotic tissue and detritus from inflammatory cells which appear more copiously only after the lupous new-formation has perished.

But Baumgarten himself adds: "I hold the differences to be sufficient to warrant a separation of the two processes from a purely anatomical standpoint. It is another question whether there is not an internal, *i. e.*, a genetic connection between both diseases; thus, that perhaps lupus has branched off from the main trunk of tuberculosis as a ramification attaining in the course of time a certain independence and provided with peculiar permanent deviations."

This question, in our opinion, may now be answered positively.

Although clinically the objection may be raised that the combination of lupus and general tuberculosis is but very rarely observed, still we may, on the other hand, point to those "latent" forms of tuberculosis which likewise run their course without the occurrence of general disease. On the other hand, in the morbid group termed scrofulosis, we shall regain the clinical connecting link between the two apparently so different forms of tuberculosis.

Experimental inoculation has unfortunately yielded here no incontrovertible result. Lupus particles were introduced into the anterior chamber of rabbits. But while Cohnheim, Hänsell, and others reported negative results, Schüller and Hüter have published successful positive experiments and in accordance therewith they interpret both diseases as the sequels of the same tuberculous poison, only that the noxa is weaker in lupus.

As opposed to the positive results of Schüller, the negative ones seem to me to lose their force; all the more because in lupus we probably have to deal with minimal quan-

tities of bacteria, so that it is likely, in a series of inoculation experiments, that sometimes bacterial, that is virulent particles, sometimes non-poisonous ineffective particles of tissue may have been employed.

Schüller reports the following about his experiments:

"By inoculating into the lungs particles of lupus tissue, I succeeded not only in provoking tuberculosis, but also, by fractional cultivation, in developing from lupus tissues micro-organisms whose inoculation into the lungs was followed by distinct and widespread miliary tuberculosis, and the injection of which into a joint incited characteristic tubercular arthritis with secondary general tuberculosis. These experiments are absolutely demonstrative. Any other, possibly accidental tuberculous infection was guarded against by the strict isolation of the animals. The animals were cared for in positively healthy, new stables, separated from the others by a large court-yard, and tended by a special person. (Besides, in other rabbits inoculated with the blood of animals affected with lupus [according to Lenz's experiments] tuberculosis could be reproduced.) Therefore, the question will admit of no doubt. Former negative results may perhaps be explained by the difficulty of securing appropriate lupus tissue containing specifically active micrococci.

Finally, the histological differences between lupus and true tuberculosis seem to me to show the similarity of the two processes. Indeed, in tuberculosis we have the same pathological tissue processes as in lupus, only more *acute* in course and of higher degree. For this reason we have in lupus the slower development of the inflammatory granulum with more ample vascular development; thence, too, slower destruction at the centre (necrosis of coagulation) and points of recovery at the periphery, with the formation of spindle-cell tissue (cicatricial tissue).

Nevertheless the local malignancy of lupus is no less than that of tuberculosis. It is only by the implication of the entire organism that tuberculosis (*sensu strictiori*) is more malignant than lupus confined to the skin.

The single lupus nodule, like the single tubercle, finally succumbs to a specific necrobiosis; but in a lupus patch the basis tissue is not so largely involved, while in tuberculosis it is regularly implicated in the caseation. In this variability we can distinguish an essential difference as little as in the spontaneous recovery of the papular forms of syphilis as opposed to the constant disintegration of the gummous products.

It is true, caseation is characteristic of tuberculosis, but still it is merely a secondary phenomenon, caused by the continuous deleterious influence of the virus which before incited the inflammation and new-formation. "Therefore, *cæteris paribus*, the earlier or later onset of caseation will depend on the intensity and duration of the influence of the tuberculous noxa." Schüller is also inclined to ascribe importance to the quality of the tissue within which the tubercular inflammation takes place; in lupus, therefore, the condition of the cutaneous organ. In fact, cases of true tuberculosis of the skin are exceedingly rare; even in cutaneous diseases developing over tuberculous patches in bones and lymphatic glands, we frequently encounter, not "tubercular" ulcers, but true lupus, "because the penetrating tuberculous noxa suffered a weakening of its intensity from some still unknown cause." It is of interest, too, that while lupus migrates, true tuberculosis of the skin has no progressive character.

For us, therefore, lupus is one of the forms in which tuberculosis occurs in the skin, modified by the small quantity of active virus; hence, it must also bear the clinical stamp of an infectious disease.

Does the clinical picture of lupus present the character of an infectious disease?

The developmental history of every single case gives us little information upon it. The simultaneous occurrence of several cases of lupus in the same family has been observed

very rarely; nothing at all is on record of the infection of a healthy person by lupus; as regards heredity, we have the unanimous verdict of authorities that those affected with lupus neither inherit the disease nor transmit it to their children; finally, stress is laid on the fact how rarely a combination of general tuberculosis with lupus is to be observed.

It will be possible to prove, however, that all the clinical relations above discussed can be most plausibly explained on the basis of our point of view of lupus—as a modified tuberculosis.

As a matter of fact, general tuberculosis (used in the older, restricted sense) is rarely to be observed with lupus. But this explains itself from the following reasons:

1. Lupus virus is for the organism a weaker and less dangerous noxa, on account of the quality of the organ in which it is localized. Schüller maintains even that the micro-organisms representing the tuberculous virus suffer a direct impairment of their infective power, because they vegetate in the skin under more unfavorable nutritive conditions. He drew this conclusion from the observation that it was sufficient to offer to the micro-organisms developed from lupus tissue relatively more favorable conditions of growth (by direct articular injection) to bring their activity back to its full power.

In the same way Koch's observation, that in cultures the growth of the tubercle bacilli is very decidedly influenced by the temperature, may possibly explain the impairment of the intensity of growth in the skin.

2. Again, the localization of this tuberculosis in the skin is a factor causing the relative harmlessness in this way, that the products of disintegration do not get into the circulation from the cutaneous investment in sufficient quantity to produce acute general tuberculosis of rapid course; the processes remain local, and as such not specially injurious to the general organism; just as a cheesy lymph-gland is succeeded by general tuberculosis only when it can in some way bring larger quantities of its cheesy masses into the current of the circulation. (For even in the most florid forms of pulmonary phthisis, general acute miliary tuberculosis is of relatively rare occurrence!)

For these reasons lupus does not become the cause of general tuberculosis!

Inversely, true tuberculosis does not always produce lupus, even when the cutaneous tissues are attacked. Then, owing to the greater intensity of the virus, it may produce genuine tuberculous ulcers. Lupus is always tuberculosis of the skin; but tuberculosis of the skin has other forms besides lupus.

3. All the more frequently, however, lupus is coupled with the complex of symptoms designated as scrofulosis.

The objections of Kaposi, who does not recognize this connection, do not seem to me to be justified. He says we have no reason to derive lupus from scrofulosis because, of the many hundreds of lupus patients we have seen, in but very few were these conditions (cheesy infiltration of the glands, the skin, keratitis, etc.) found, and in other hundreds of scrofulous patients no trace of lupus can be discovered. "The same is true of tuberculosis," etc. (p. 624). The first point is in direct contradiction to by far the greatest number of other observers of all countries; as to the second objection, it is not necessary that in every scrofulosis lupous skin disease should develop, any more than the so-called scrofuloderma is a regular occurrence in scrofulous patients.

Raudnitz has recently examined the lupus material of the Prague clinic with a view to its etiology. In 209 lupus patients he found only 30% in whom there was obvious scrofulosis, so that he expresses himself against a constant relation between lupus and scrofulosis, "although, on the other hand, the concurrence of both affections cannot be

looked upon as accidental." In twenty-one cases there was decided hereditary taint, in nine others this appeared probable.

An investigation by Pontoppidan showed that in one-half to two-thirds a scrofulous basis was demonstrable.

Inasmuch as the unity of scrofulosis and tuberculosis is no longer doubted, and as, on the other hand, the connection between lupus and scrofulosis appears to us to be proven, we may, even from a clinical standpoint, include lupus in the group of tuberculoses. For scrofulosis is nothing else but a peculiarly localized tuberculosis, in which the virus, when it penetrated into the body, reached and localized itself in the lymphatic glands without direct injury to the mucous membranes which acted as points of entry. Frequently enough such a scrofulosis is completely recovered from: at any rate it remains harmless to the general organism as long as its products are not transferred to other organs. Only after the tubercular virus is spread in the body and additional disseminated patches are established in more favorable and more dangerous developmental locations, the disease begins which is called tuberculosis in a more restricted sense. The difference of tuberculosis from scrofulosis and lupus, therefore, does not lie in the variation of the poisons (though perhaps in the quantity of the virus), but in the variable spread in the body and in the different importance of the affected organs. Of these, lung tissue, succumbing most rapidly to the disintegration, is most dangerous to the organism; neck, lymphatic glands, and skin, however, remain localized foci of disease, usually without any injurious influence on the body.

In this connection we may point to another infectious disease, the pathogenetic fungi of which are very well known—actinomycosis. Similar to syphilis and tuberculosis, that affection presents the most variable forms of disease, although in all, the same fungus has been demonstrated as the exciting cause. Sometimes we find the most perfect tumors, the granulation tissue of which even attains a relatively high development, approaching that of perfect connective tissue, with giant-cells (Weigert), etc. Sometimes, again, there is nothing like a tumor, but chronic abscess formation, carious osseous processes, and phlegmonous suppurations are the pathological processes caused by the actinomyces. But they all have a common etiological factor—the ray fungus.

Again resuming the results obtained, we would assume genetically but one tuberculosis of the skin which, however, appears in different forms:

*a. Tuberculosis* in a more restricted sense, with the formation of ulcers seated in the cutis, and with miliary tubercles, as a part of general tuberculosis.

*b. Lupus*, a less harmful form of tuberculosis, usually remaining confined to the skin.

*c. Scrofuloderma ulcerosum, i. e.*, ulceration arising after the opening of the so-called cold cutaneous abscesses. (Scrofuloderma papulosum of Auspitz does not, in our opinion, belong here; it is, as Hebra correctly states, a lichen scrofulosorum.)

4. The infectious nature of lupus is most clearly recognized when considering the clinical course of a single case; the gradual irresistible progress of the process into the neighborhood, and especially the local relapses, cannot be understood without assuming the presence of a reproductive germ of disease, *i. e.*, of pathogenetic organisms; particularly instructive are the not uncommon cases in which healthy flaps from the forehead, which have been transplanted for the formation of an artificial nose, become attacked by lupus before long.

We shall not be mistaken if we assume that in the adjoining and the basis tissue of the destroyed nose an organized virus has remained behind, which infected the healthy skin.

5. Finally, direct infection from without is not excluded, especially in cases in which there is an absence of signs of tuberculosis and scrofulosis in other organs; for the tubercular micro-organisms penetrate through small fissures or wounds into the skin, where, if they have time to breed, they deposit products superficially. Schüller attempts thus to explain the great frequency of lupus in the face, in the neighborhood of the nostrils, and of the mouth; not only that rhagades and superficial defects there are frequent, but the inspiratory current is said to be an auxiliary leading the microbes there by preference. On the extremities, too, lupus usually occurs on the hands, fingers, and toes, that is, points likewise more exposed to external injuries. According to Raudnitz, lupus occurred primarily at the nose, the inner canthus, and lip in 38.2%; on the cheek, in 27.4%; on the trunk and extremities, in 24.5%. Inversely, Schüller supposes that the organisms circulating in the blood deposit local foci in the skin, and thus may produce lupus.

But eruptions of lupus over softening, cheesy glands and abscesses, *i. e.*, infection of the skin from within, have been certainly demonstrated and observed with sufficient frequency.

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Patho-anatomically the process is: the virus causes an inflammation; but the inflammatory products, under the specific influence of this virus, take the course peculiar to tuberculosis—after a progressive development of the inflammatory cells into epithelioid and giant cells, they perish, with the tissue framework present, by necrosis of coagulation and caseation; another characteristic is the irresistible peripheral extension of this first inflammatory, then necrobiotic process.

The process runs its course exclusively in the connective tissue.

The implication of the epithelial formations occurring in lupus is quite secondary. Histologically this proliferation, which not rarely assumes large dimensions in an "atypical" manner, is of importance. But the proper nature of lupus has nothing whatever to do with this epithelial growth; lupus is a new-formation in the connective tissue, and causes, on the one hand, an excitation into more active growth of the epithelial stratum, but, on the other, a diminished resistance, without which a proliferation into the connective tissue would be impossible. The carcinomatous processes have just as little essential relation to the lupous process as these "atypical" epithelial proliferations. That carcinoma will develop more rapidly and more malignantly in this friable granulation tissue is natural, but otherwise we can see nothing but an accidental combination in this development of carcinoma into lupus.

### 1. *Tuberculosis of the Skin.*

The knowledge of tubercular affections of the skin dates only from the last few years. Their occurrence is uncommonly rare in comparison with tuberculosis in other organs. Generally, the nature of these cutaneous affections is first recognized in the microscopic examination made post-mortem.

Without any special precursors, isolated, roundish-oval ulcerations arise which soon become covered with crusts and are but moderately painful. After removal of the crusts, a reddish-yellow, granulated, slightly bleeding, shallow ulcerous surface presents itself. The borders are slightly infiltrated, but soft; not undermined, though displaceable on their base; they are not smooth, but jagged and eroded, from an aggregation of small depressions, covered with pus. True "miliary tubercles" of the ulcers, or even of the uninjured skin, are among the greatest rarities.

The ulcers spread by continuous, very slowly progressive destruction of the surroundings, becoming "serpiginous," thus sometimes giving rise to the confluence of adjoining isolated ulcers. Still the ulcers generally remain small, rarely exceeding the size of ten to twenty square centimetres. Of course, there is no such thing as healing of these ulcerations which, as above stated, occur only in very greatly developed tuberculosis. The seat of the ulcers is almost invariably in the immediate neighborhood of the orifices covered with mucous membrane: upper and lower lip, points around the anus and vulva, glans. Other parts of the cutaneous investment are very rarely attacked.

Vidal observed a peculiar case in a patient aged 22, suffering from pulmonary phthisis. Seven months before, the patient had noticed on his breast two closely adjoining, hard nodes about the size of beans; they gradually softened and opened after increasing discoloration of the overlying skin, discharging a whitish, tough mass. Similar nodes by degrees developed in the face, on the shoulder, the arm. Vidal interpreted these nodes as tuberculomata—a diagnosis which he verified microscopically after the autopsy (scrofuloderma?).

The DIAGNOSIS rests on negative rather than positive facts.

In the first place, tubercular cutaneous ulcers occur only in the course of very intense general affection, a few months previous to the death of the patient. It will not be easy, therefore, to diagnosticate them in the absence of evident tuberculosis in other organs. A specially valuable indication is the simultaneous presence of tubercular affection of contiguous mucous membranes; this will be particularly serviceable in the case of suspicious ulcerations on the lips if the oral cavity be at the same time affected (Küstner). The oral affection consists of ulcers accompanied by pain; they may now and then develop on the soft palate from isolated grayish-white nodules the size of a millet-seed, hence true "miliary tubercles." These nodules change into small, roundish superficial losses of tissue of corresponding size, which soon spread and coalesce into soft, jagged ulcers. At the periphery, fresh nodules seated in the mucous membrane spring up and gradually perish in the same manner. In a case described by Jarisch, the affection had spread in one week over the whole soft and hard palate.

Should no miliary tubercles be found during life to settle the diagnosis, the latter is formed without difficulty by the microscope post-mortem. In the pretty uniformly infiltrated tissue of the bottom (deprived of its epithelial covering), as well as in that of the borders, we find the lymphoid, epithelioid, and giant cells composing the roundish nodules caseating in the centre; besides, we often find them at a great distance from the proper seat of the disease, in macroscopically apparently healthy tissue. These formations, to be designated at once as "tubercles," are often situated along the vessels.

From the above-described symptoms, it follows that the diagnosis in the main will have to be formed by exclusion.

As opposed to the serpiginous-ulcerous syphilides, tuberculosis is characterized by:

1. The materially slower course.
2. The lesser painfulness.
3. The absence of the solid, firm infiltration which is characteristic of syphilitic ulcers with generally wall-like elevated margins. In tubercular ulcerations we shall have to search for the scattered grayish-white nodules (miliary tubercles), and the small roundish exulcerations due to the disintegration of the small marginal nodules.

*Epithelioma* is clearly distinguished by the hard quality of its borders and the much more rapid course.

Tubercular ulcerations on the genitals and in the urinary passages resemble chancres and are easily mistaken for them. In the scant literature we find reports of extensive

ulcerations of the urethra which appeared like a chronic gonorrhœa; also of numerous minute ulcers situated on the glans, its neck, and partly on the inner layer of the prepuce, many of which represented the features enumerated as characteristic of chancre—deep base and sharply sloping margins. The differentiation will be easily furnished by experimental inoculation. In the case of a soft chancre, it will be possible to produce with almost absolute certainty inoculation ulcers which may be further transferred in generations, and having the period of incubation peculiar to soft chancre. In the case of tubercular ulcers, however, the demonstration of bacilli or the inoculation of animals will render an accurate diagnosis possible in many doubtful instances.

Mention should also be made of the ulcerations of the skull belonging under this head; they may be due to tuberculosis of the bones of the skull, and are important as mistakable for gummous ulcers.

"With rather vague symptoms and at first unchanged cutaneous investment, an abscess formed on the skull having so relaxed a feel as to be taken for a traumatic cephalhæmatoma, and containing, when opened spontaneously or operatively, ample quantities of a characteristic cheesy pus. After laying the abcess open by a large incision, its inner surface was found covered with numerous fungous granulations containing many cheesy miliary tubercles as shown by the microscope. These granulations could be easily wiped off in a characteristic manner, and then the diseased part of the cranial bones whence the abcess had sprung became clearly evident."

The laxity of the neoplastic mass, the fluidity of the contents of the abscess distinguish this tubercular process sharply from the firm infiltration produced by syphilis.

### 2. *Scrofuloderma.*

By the name "scrofuloderma" we designate those affections of the skin which arise under the direct influence of scrofulous processes. Granulation-like masses form which develop in the subcutaneous cellular tissue, where they cause extensive detachment of the skin from its support, gradually blend with the overlying cutis, and after thinning of this cutaneous covering—which finally, of the tenuity of paper, consists only of the well-preserved epithelial elements of the skin and of very dense elastic fibrous networks—leads to the production of typical ulcerations.

These subcutaneous masses of granulation arise either primarily in the subcutaneous connective tissue or, more frequently, as sequels above softening scrofulous lymphatic glands. Perilymphangitic abcesses at times also form the starting-point of these processes. The course in every one of these cases is a rather analogous one.

There is formed a moderately firm circumscribed infiltration which may be displaced under the epidermis; it is unaccompanied by pain or any other subjective inconvenience (période de crudité). The shape is round or oval. Corresponding with an increasing softening (période de ramollissement) of the tumor, often the size of a pigeon's egg, the epidermis is gradually implicated in the process; it adheres to the tumor, becomes hyperæmic, assumes a bluish-violet aspect, and grows thinner and sensitive. Finally, often after the lapse of months, the covering over this now clearly fluctuating cold abcess is perforated (période d'ulcération) and from a small irregular opening a thin yellowish-white fluid is discharged which consists mainly of white blood-corpuscles in a state of fatty degeneration. This completes what we call scrofuloderma ulcerosum.

The form, size, and depth of these ulcers vary greatly and depend upon the point of origin of the infiltration. If it has sprung primarily from the subcutaneous tissue, a

superficial, shallow ulcer results. If one or more lymphatic glands have taken part in the infiltration and softening, we will witness the formation of a deep, sinuous ulcerous cavity from which long fistulæ often extend into the depth. In a few rare cases the infiltration and succeeding deliquescence assume particularly large dimensions. The skin and soft tissues beneath, and even cartilage and bone, are attacked and destroyed, so that fearful mutilations may occur in the face by the loss of the lips, the nose, the palate, etc. The borders are moderately infiltrated, often as thin as paper, soft, relaxed; they are demarcated from the base of the ulcer by an irregular, thin margin—a condition caused by the maceration progressing at the inferior surface; they are also undermined, that is to say, the extent of the ulcer is larger than the opening of the original abscess. In the region of the subcutaneous abcess formation the margins of the skin are discolored livid, almost violet, and shade gradually into the healthy skin. The base of these ulcerations is uneven, and shows limp, pale granulations, covered with yellowish, thin masses of pus, which bleed easily. When the secreting masses dry, thin brownish or yellow-colored crusts arise, beneath which fresh thin, fluid pus soon reaccumulates in large quantity. There is no special infiltration of the base and of the margins, nor any painfulness! Now and then there may be very prominent proliferations, before the excoriation and ulceration of the cutaneous investment occur. With this there may be developed not only one, but several small openings. Particularly on the hand we may observe such forms which then give rise to great deformities by the deeply retracted cicatrices and the changes in the bones which are not rare.

The number of the processes occurring simultaneously in the same individual is usually limited and varies between two and six. Characteristic for all these forms is the torpid course and a corresponding lack of acute inflammatory symptoms; hence it happens that patients have no suspicion of the origin of the tumor and have their attention directed to the affection only by the evacuation of the abscess.

How chronic the course is is shown by the gradual enlargement as well as by eventual closures. In the latter are formed smooth, pale and flexible—or, in the case of very irregular ulcerations, distorted—cicatrices crossed by a network of bridges of healthy skin. The most common seat of these ulcerations is on the leg, the neck, and the face. The size varies much and not rarely reaches a diameter of three to five centimetres. Duhring includes in this category the cutaneous affection described by us as acne cachecticorum. However, as this is an affection of *scrofulous persons* and not a *scrofulous* affection, we hold this classification to be inappropriate.

A more general form is described by Van Harlingen: a woman aged 70 had been affected for twenty years with a disease which had begun as a slowly increasing roughness of the skin of the lower extremities and had led to reddish-brown to ashy-gray discoloration. Initial nodular efflorescences covering the entire skin gradually changed into macular or scaly patches, nodes, and ulcers. The patient died of exhaustion. Examination showed universal cellular infiltration in the corium which was evenly distributed without the formation of groups.

Diagnosis.—The diagnosis is based on the one hand on the above-described, characteristic appearance of the developing masses of granulation, as well as on that of the ulcerations already disintegrated; on the other hand, too, on the simultaneous presence of other processes peculiar to scrofulosis; on the eye, lymphatic glands, bones, with the pale, anæmic, often bloated skin, etc.

In the *differential diagnosis* have to be considered:

1. All those ulcerations, sometimes called ecthyma, sometimes rupia, which we,

following Hebra's doctrine, class as more or less accidental concomitants of other processes; for instance, the forms of ulcers due to large excoriations (especially from pediculi vestimentorum).

2. Especially syphilitic gumma in all its different stages of development which pretty closely correspond to those of a scrofulous infiltration. Essential to the differentiation are here:

*a.* The absence or presence of former symptoms of syphilis. If syphilis be absent in the history or in the examination, this furnishes a diagnostically valuable support. But inversely, if there was a former syphilis, the possibility of the coincidence of syphilis and tuberculosis is still to be taken into consideration.

*b.* Scrofulous abscesses are almost exclusively found as concomitant phenomena of general scrofulous disease, while gummata frequently appear in otherwise healthy persons (syphilis in a late stage).

*c.* The scrofulous neoplasms are generally more numerous than gummata. The latter, moreover, show a preponderating tendency to localize on the forehead and the portions of the skin covering the long bones.

*d.* The scrofulous abscesses always spring from the subcutaneous tissue, very frequently from the lymphatic glands. Gummous infiltration is as often cutaneous as subcutaneous, and gummata have nothing whatever to do with the glands.

*e.* The different appearance of the formation also decides; in the initial stages, gumma is harder and firmer than the scrofulous mass of granulation. In the stage of softening, fluctuation is slighter in gumma. In the ulcerative stage, the differences are still more obvious; here a hard, firmly infiltrated gumma mass, which does not collapse even after opening, with but very slight gummous secretion; there an abscess with relaxed borders, loose base, and equally flabby environs, which at once collapses with the discharge of the thin, fluid pus.

*f.* The ulcerous forms of syphilis are clear cut, usually painful ulcers, with steep, firmly infiltrated borders; scrofuloma ulcerosum, however, presents itself as a painless ulcer, with thin, soft, irregular, undermined borders, which, besides, enlarges much more slowly than the serpiginous luetic ulcers.

*g.* Finally, the exhibition of potassium iodide may settle the question. This agent causes rapid absorption of the gummous neoplasms, while it scarcely influences the course of the scrofulous new-formation.

*Treatment.*—This consists essentially in a roborant general treatment directed against scrofulosis: cod-liver oil, syrup of iodide of iron, etc. The local treatment is chiefly surgical: removal of the caseated and softening infiltrations with the sharp spoon; ablation of the thinned borders with knife and scissors, and a stimulating dressing to the granulation of the bottom of the ulcer. Wine of camphor, silver nitrate ointment (one to two per cent), best iodoform dusted on in powder, or dissolved in ether, or as an ointment dressing (one in fifteen), etc. At any rate, as long as there is profuse suppuration, sufficient egress must be given to the pus. Atomization of iodoform-ether (1 : 15), or camphorated iodoform ether, is especially appropriate for sinuous ulcerations which are accessible with difficulty (in the nasal or oral cavity). Lymphatic glands must eventually be removed, osseous fistulæ scraped out.

In the case of these scrofulous abscesses and fistulæ, we must bear in mind that the granulating surfaces are often covered with granulation epithelium (Friedländer), which of course prevents the direct union of opposite wound surfaces, and accordingly must be removed (with the sharp spoon).

### 3. *Lupus.*

The morbid picture of lupus belongs to the most manifold and changeable of all forms encountered in dermatology.

The morbid process consists in the fact that (either by direct infection from without or from within from subcutaneous foci) the skin is penetrated by a specific virus at present still unknown, but, we suspect, to be identified with the bacilli of tuberculosis. This virus acts in the first place by exciting inflammation, and thus gives rise to the formation of small inflammatory patches situated along the vessel walls. These small neoplasms, composed of inflammatory granulation tissue, appear on section as little spherical nodules (granuloma, lupus nodules), and are deposited in midst of a connective tissue likewise diffusely infiltrated with inflammatory cells. The virus subsequently exerts its specific qualities in two directions.

1. It influences the course of every single new-formation produced by it.

2. It causes peripheral migration of the neoplasms by spreading also into the healthy periphery.

Ad 1. In the centre of every nodule (*i. e.*, a spherical accumulation of small lymphoid cells which are embedded in a fine fibrillary connective-tissue mesh-work, and between which project sparse blood-vessels from the periphery) the virus produces destruction of the cells as well as of the fibrillary basement tissue; a specific necrosis develops, a "caseation," while toward the periphery of the nodule progressive developmental phases are found in the cells: the formation of large epithelioid and giant cells. But even these are only temporary formations, because they, like the central cells, gradually succumb to the necrobiosis extending outward.

Ad 2. While these processes take place in the single lupus nodule which has been called very happily the "primary efflorescence" of lupus, the virus has migrated into the neighborhood, and there has again produced "nodules," on which the old process is repeated. These, too, caseate, and, as the nodular masses all perish one after another, not only the first-attacked portion of tissue is destroyed, but likewise its surroundings which coalesce with the new-formation both in width and in depth, and perish.

With this most important point—formation and disintegration of the lupus nodules under the influence of a virus spreading into the periphery—other factors come into consideration, which, though in themselves of secondary importance, very materially modify the clinical picture of lupus. These are:

1. The manner of the spread of the lupus poison and the lupus nodules (primary efflorescences) produced by it.

2. The participation of the internodular connective tissue which is either limited to a simple, temporary infiltration with inflammatory cells, or may lead to node-like hyperplasiæ, at times circumscribed, at others general, approaching elephantiasis.

3. A special activity of the papillæ, by which eventually papillary, horny excrescences are produced.

As regards the epithelium, however, it participates to a slight extent, and contributes little to the specific character of the morbid picture.

Therefore, by lupus vulgaris we understand a chronic cutaneous disease which arises from the introduction of small patches of infiltration into the tissue of the skin, and progresses by the peripheral spread of ever renewed similar patches, while the older ones perish by slow absorption, or by necrobiosis leading to ulceration. The variable participation of the connective tissue and the papillary body produces different forms, on the description of which we shall now enter.

*Lupus maculosus.*—The primary efflorescences, the lupus nodules, are perceptible as small spots the size of a millet-seed through the epidermis, which is slightly depressed at these places situated in the midst of a cutaneous surface which otherwise appears quite normal. The color of these spots is a yellowish-brown, the intensity of which can be only imperceptibly lightened by pressure with the finger. The skin above the spot is smooth or very slightly scaly; it is glossy, especially on side illumination, because the normal linear tracing is absent. The most characteristic feature is the consistence. A light pressure with the blunt knob of a sound suffices to penetrate through the epidermis-layer into the cell-mass and to bury the knob in the depth; while otherwise the epidermis is impenetrable to a blunt instrument even on strong pressure.

The lupus nodules are always situated in the connective-tissue part of the skin, both in healthy, formerly intact portions, and in old cicatrices in which the color contrast of the yellowish-brown infiltration with the whitish scar, of course, is especially evident.

Lupus maculosus is always the first stage of the development; it is found, therefore, either as the first sign of the affection generally, or in the periphery of older foci, or as a relapse in cicatricial surfaces, usually in small, more or less circularly arranged groups.

No subjective inconveniences are connected with the development of the lupus nod-

*Lupus exfoliativus.*—In the further course, which is very chronic, there are now developed very numerous, closely packed nodules, the final result being a generally circular lupous surface, two to three centimetres in diameter, brownish-red to brownish-yellow in color. The central oldest portion is usually already in a state of regressive metamorphosis (fatty degeneration, caseation, and cicatrization), hence darker and depressed, while toward the periphery the more recent lupus efflorescences are lighter in color, and often united into a slightly elevated, wall-like crown. Besides this closely packed conglomeration of lupus nodules (which, therefore, do not represent a uniform diffuse infiltration), the healthy surroundings are sprinkled with isolated, most recent nodules.

The deep-seated infiltration, having led to the destruction of the papillary body and flattening of the cones of the rete, robs the surface of such extensive patches of lupus of its linear tracing: the surface, therefore, is glossy. Withal, the adherence of the cornified epidermis cells is impaired, hence the surface is scaly, rough, and fissured. The transverse diameter of the skin is thinned, and consequently becomes easily wrinkled and folded. This quality of superficial desquamation of the epidermis has given this developmental form the name of lupus exfoliativus

Of late I had two opportunities of seeing lupus forms belonging under this head, which were spread over large surfaces. In the course of many years (twelve to eighteen), the affection had involved almost the entire thigh and the whole of the gluteal region, without having led to ulceration or healing at any spot. The gradually enlarging affection represented a uniformly glossy, slightly scaly, brown surface, covered with wrinkled epidermis; at first sight, it looked even more like an abnormally colored psoriatic surface than like lupus. Some primary efflorescences, however, soon determined the diagnosis, which was confirmed by the microscope. The latter demonstrated a very copious infiltration with groups of granulation cells (with very large and numerous giant-cells) in the uppermost layers of the corium, and in the papillæ between the cones of the rete. In the subcutaneous tissue the lupus nodules were very sparse.

*Lupus exulcerans.*—Now and then healing processes take place, *i. e.*, melting down and subsequent cicatrization without destruction of the epidermis, a kind of subcutaneous scar-formation (cicatricial atrophy). Usually, however, the intensity and acuteness of the necrobiotic processes in the lupous tissue, the caseation and softening, are so great,

and by irritation from without more vivid inflammatory phenomena are superadded to such a degree that the normal epithelial covering is destroyed, and the disintegrating lupous infiltration is freely exposed. A more copious secretion, "suppuration," of this wound-surface at once ensues, so that now we speak of it as an "ulcer": lupus exulcerans.

What is the nature of such a lupous ulcer? The base is usually covered with yellow and (by admixture of blood) brown, not very thick, flat crusts. If these be lifted and the underlying puriform fluid, consisting of pus-cells and detritus, removed, we expose the red, somewhat irregular base covered with flat granulations; it bleeds easily and shows the same consistence, at once yielding to every instrument, as the single lupus efflorescences. The borders imperceptibly blend with the base of the ulcer; they often exhibit, for a distance of several centimetres into the surroundings, the brownish-yellow color and the soft consistence of lupus skin, at times they are also slightly elevated, wall-like (by more massive infiltration).

*Lupus serpiginosus.*—The granulations, that is to say, the freely exposed corium and subcutaneous connective tissue infiltrated by lupus, now gradually disintegrate, and are replaced by newly forming, persisting connective tissue, which is gradually covered with epithelium from the neighborhood; thus a further stage is reached. The lupus heals, and very dense, firm, irregularly distorted, retracting cicatrices result. Such healing, however, is effected only in the centre, or at one segment of the circular ulcerating surface, namely, where the lupus poison has died, and, therefore, no longer prevents the tendency to recovery. But it is all the more active in the still affected peripheral zone; there it "creeps" onward (lupus serpiginosus).

But under some circumstances the inflammatory neoplasia of the connective tissue in the base of the ulcer may preponderate over the necrosis: greatly elevated proliferations of granulation then form, which not rarely may organize into some permanence, become covered with skin, and thus remain unchanged for years. In other cases the proliferations are more relaxed, more friable, and bleed easily. Under the microscope we distinguish a tissue built up of young connective tissue, more or less interspersed with lupus nodules. This connective-tissue formation, proliferated under the chronic irritation of the lupus poison, is termed Framboesia luposo or Lupus framboesioides.

The same process, however, is found not only springing from the base of the lupus lucerations, but, more frequently, as a developmental form of lupus maculosus (still covered with epidermis). In this case are formed chiefly firm neoplasms composed of a connective tissue representing different degrees of development of the inflammatory connective-tissue new-formation and almost identical in structure with ordinary elephantiasis. We then observe brown or brownish-red, soft or firmer elevations from a pea to a nut in size, either spherical or like low flower-beds; their surface is smooth, or slightly scaly, often excoriated and covered with thin crusts. If the development of the papillæ—*i. e.*, the growth of its ascending vascular loops with corresponding depression of the cones of the rete—is especially prominent, verrucose nodes arise which permit the recognition of the papillary structure on the surface: *lupus papillaris, verrucosus.*

But all these neoplasms, despite their frequent persistence for years, are not permanent. Sooner or later, with the interspersed lupus nodules, the connective tissue inclosing them likewise perishes.

We have thus far become acquainted only with extension of lupus by contiguity. Besides, we speak of a *lupus disseminatus* (*discretus*) when the several foci appear on

different parts of the body either simultaneously or in succession, in which case every patch may independently change into a lupus serpiginosus.

As to the extension into the *depth*, the virus migrates in the lymph channels, around the ducts of sudoriparous glands which penetrate deeply, etc., progresses along the vessels, penetrates the connective tissue, stopping as a rule at the firm fasciæ and the bones. Now and then, however, the periosteum is also destroyed, giving rise to more or less superficial necroses of the bone. Cartilaginous tissue is very readily attacked by lupus and penetrated by the neoplasm.

In by far the majority of cases of lupus, the disease shows itself first on the external skin, and thence extends to the mucous membranes (mouth, pharynx, larynx, conjunctiva, etc). In rare cases primary lupus of the mucous membranes has been observed, and then, as a rule, the small brownish-red "nodules" are not to be seen. Small whitish exfoliations of the epithelium show themselves in the livid-red, slightly thickened mucosa. Subsequently they change into small warty prominences which either still exhibit the whitish, thickened epithelial coating or have a red, easily bleeding surface.

The lupous process may occur on any part of the body, but attacks the face and the extremities with the greatest frequency. Usually the patches are isolated, not exceeding the size of the palm of the hand; only in rare cases it covers the entire face, neck, and parts of the trunk.

*Lupus of the Face.*—It begins either in isolated flat macular form on one or both cheeks, and usually remains for a long time unnoticed by the patient; or else, on the nose in the form of lupus tumidus, tuberculosus, gradually leading to swelling and livid discoloration. While the central portions heal with the formation of cicatrices, the process spreads in the neighborhood either serpiginously or by peripheral extension of fresh isolated groups of nodules, involving the upper lip, the forehead, and eyelids. Then follows a gradual confluence of older, originally isolated patches, thus leading to extreme disfigurement. The cicatrized surfaces are not only themselves irregularly distorted, but they also cause ectropion of the eyelids and lips which is rendered all the more conspicuous by the swelling, partly œdematous, partly by lupous infiltration, of the surroundings. The disfigurement becomes still greater by the interspersed ulcerations covered with crusts, and the variable color of the several patches, changing with the age of the process. After the infiltration has spread in the deeper subcutaneous and intermuscular layers of tissue, a more regular swelling of the livid discolored surface results, often without external cutaneous manifestation of the deep-seated infiltration which becomes visible at the surface only in the course of time, by means of long fistulous tracks with irregular ulcerous openings. The morbid picture is completed by the prominence of the groups of glands on both sides of the face and in the submaxillary region, the softening and caseation of which sooner or later implicates the skin and cause fistulæ and indolent ulcerations (scrofuloderma). It is especially noteworthy that the cutaneous affection over these "scrofulous" abscess cavities bears the typical character of lupous disease. Lupus of the forehead usually presents a flat macular form, without any particular tendency to disintegration. But often it extends to the scalp (where it may lead to caries of the cranial bones), also to the upper eyelids which become ectropic.

But the most serious deformity is caused by lupus of the nose and upper lip.

Lupus of the nose may be a L. maculosus and exfoliativus which has deposited a flat infiltration on the ala or the dorsum. With the absorption of the neoplasm the basement tissue also perishes, and as a result there is shortening, shrinkage, mutilation,

diminution of the nose. When the affection has been pretty uniformly distributed over the surface, the organ is reduced in all its diameters, its point is retracted as by a bridle.

Or else the volume of the nose is increased if the form be of the tubercular variety, with more copious neoplasia of more acute onset. The nose now is brownish-red, irregularly swollen with knobby elevations, the surface is rough, usually with shallow ulcers, and covered with thick crusts and dirty scabs. In the neighborhood, isolated lupus nodules are seen scattered over the healthy tissue. The pituitary membrane also becomes implicated. The membranous and the cartilaginous septum, also the cartilage of the roof of the nose and the alæ, become infiltrated, thickened, and covered with inspissated masses of secretion which not rarely completely occlude the nostrils. But when the disintegration begins spontaneously or when the physician removes the lupous masses mechanically, we get an insight into the extent of the destruction. Instead of the club-shaped enlarged nose, not rarely a small remnant, confined to the osseous part, remains behind; the membranous and cartilaginous portions are to a great extent missing. Even now, however, the process does not come to a standstill, but migrates backward on the mucous membrane of the nasal cavities and the septum, leading to the formation of enormous crusts on the ulcerated surfaces, even to the sequestration of the bony parts of the nasal framework, of course with corresponding diminution of the air passages.

The destruction of the membranous and cartilaginous septum narium comes under observation also with intact skin, so that the nose is depressed *in toto*, the roof being straight.

Lupus of the *upper lip* very soon extends to the mucous membrane, where it causes an uneven surface resembling granulations. The lip is enormously swollen and everted, irregularly traversed by rhagades, fissured, bleeding easily. Should such a rhagade-like ulcer heal, the deep scar and band-like retraction increase the disfigurement. Finally the mouth can no longer be closed, thus still further favoring the ulceration of the mucous membrane. After the process has extended for years, those terrible deformities result which nowadays fortunately come under observation only from regions far removed from medical aid.

Lupus also extends farther on to the mucous membrane of the oral cavity. The gums, the mucosa of the soft and hard palate, become soft, tumefied, the investing epithelial layer loosened and whitish, until bleeding defects result which are sometimes covered with proliferating granulations of great persistence, sometimes soon give place to a superficial cicatrix. But when the lupus penetrates more deeply, very extensive ulcerations result which finally terminate in the permanent destruction of the velum palati, the uvula, the tonsils, etc. The epiglottis, too, as well as the mucous membrane of the larynx, become involved, then showing a surface with slight tuberosities on a diffusely swollen and greatly reddened base. Ulcerations succeed and the formation of contracting cicatrices terminates the process which leads to extreme hoarseness, attacks of dyspnœa, and finally total aphonia.

*Lupus of the auricle;* great swelling of the whole of the pinna very soon develops. Specially characteristic is the enlargement which the lobule undergoes, making it depend from the cartilage as a soft, pear-shaped tumor; the epidermis may remain intact for a very long time, and gives place to a uniform, superficial ulceration at a late period. The auricle and the neighboring integument may be almost totally destroyed, the subsequent cicatricial formation occluding the external auditory meatus.

*Lupus on the neck* develops either in direct continuity from the face, in the shape

of shallow ulceration, and final cicatricial formation drawing the head forward; or else in isolated patches developing over softening lymphatic glands in connection with so-called scrofulous ulcers (see above).

*Lupus of the trunk and the extremities* usually occurs in a typical serpiginous form, and, in the course of years, covers large portions of the body. Of greater interest are the patches of lupus situated on the *joints,* which may give rise to disturbances of motility by the formation of ulcers and subsequent cicatrization. Flexion and extension are then often very materially impaired. On the hands, the bones are likewise implicated; caries and necrosis, deep ulcers and firm cicatrices arise, the fingers become curved, shortened, phalanges are sequestrated and cast off, subluxations form, etc. Often enough we are compelled to perform amputation. Otherwise, lupus of the extremities is distinguished rather by the combination with a hyperplastic involvement of tissue; we find massive tumefactions, usually covered with crusts, diffuse and circumscribed thickenings (dorsum of the hand); a diffuse hypertrophy of large segments (feet, legs), comparable with elephantiasis, develops; moreover, the form of lupus papillaris s. verrucosus is nowhere as frequent as on the extensor surfaces of the elbow and knee joints, on the dorsum of the foot, and around the lupous ulcers on the legs. "The limb is thickened so as to resemble a wooden leg; the skin with the subcutaneous connective tissue, the soft parts, and bones is changed to a rigid mass, not firm, irregularly nodular on its surface, here and there glossy, tense; at other points covered with thick, dirty epidermic callosities, on still other parts, set with warty excrescences and spinous outgrowths."

*Lupus of the Genitals.*—On the male genitals we usually find infiltration of the prepuce to which the lupus has migrated from the neighborhood (buttocks, thigh). On the female genitals, the lupous ulcerations are of special importance, on account of the differential diagnosis from other forms of ulcers. Their occurrence is comparatively rare.

*Lupus of the Mucous Membranes.*—This form has nearly always migrated to the mucosa from the contiguous skin. "Lupus nodules," in as distinct an isolation as on the skin, are, of course, not recognizable; there are rather papillary excrescences with whitish epithelial opacities above the small spherical lupus infiltrations which are not recognizable microscopically. The excrescences unite into patches with roundish serpiginous borders, finally breaking down into ulcers. These ulcers are distinguished by their persistence, because the cicatrization is retarded by relapses in the granulations. Thus there are frequently immense proliferating granulations (frambœsia luposa) which disintegrate late and leave unsightly tumid cicatrices. Primary autochthonous lupus of the oral mucous membrane, of the larynx, and of the conjunctiva is exceedingly rare. Still, a large proportion of these cases is certainly overlooked. Many so-called eczemas of the Schneiderian membrane are probably nothing else but lupus, without our being able at the time to verify such a supposition unless more extensive destruction of the septum or the appearance of lupus on the integument furnish further diagnostic landmarks.

A very frequent complication of lupus is erysipelas, in consequence of the ulcerating surfaces favoring the entry of erysipelas-cocci. Some authors claim to have observed rapid healing of lupus by the erysipelatous process.

Course.—Most cases of lupus develop in childhood, between the third and tenth years; they begin with isolated, small patches, which, as a rule, escape notice. In this way, the small lupous infiltrations on the extremities remain for years, or at most give rise to superficial ulceration and cicatrization, until about the time of puberty, when

suddenly a rapid development occurs with destruction of the affected portions. After puberty the occurrence of lupus is rare.

In reference to the number of places of eruption, lupus appears either in one single patch, or simultaneously in a number of disseminated foci. In the latter case, of course, the prognosis is more unfavorable.

The spread of the process is always very slow and extends over many years before a more important development in extent or depth ensues. Lupus maculosus and exfoliativus are much more insidious and hence more benign than the far more rapidly extending lupus exulcerans in which suppuration is associated with the destruction of the tissues.

Owing to the exceedingly chronic course in most cases, the influence of the disease on the general health is little or not at all injurious. Only the complications resulting from the suppuration of the glands, the formation of long fistulous ulcers, the erysipelata and lymphangitides, etc., starting from lupus ulcers, may in a few—certainly rare—cases give rise to danger.

As regards the PROGNOSIS of the local process, local healing, both spontaneously and after therapeutic measures, takes place; but in every case there is danger of relapse. Very often we see in the midst of large cicatrices (old lupus ulcers) the primary efflorescences spring up anew; even in large transplanted flaps from the healthy forehead the development of lupus nodules, by immigration from the nose, is of frequent occurrence.

Lupus is far more frequent in females than in males.

ETIOLOGY.—According to our hypothesis, lupus is nothing but tuberculosis (s. scrofulosis) of the skin, produced by the bacillus of tuberculosis. Only the localization of the bacillus in the skin, the relatively rare involvement of other organs, give rise to the peculiarity of lupus as opposed to the other forms of tuberculosis.

Qualitatively (probably) the bacilli are the same, only quantitatively there is a difference which is intensified by the less favorable nutritive conditions in the cooler skin. Complications with tubercular affections of other organs—glands, joints, bones, even with analogous cutaneous diseases, scrofuloderma ulcerosum, etc. (scrofulosis)—are very frequent; their absence has no argumentative force against the tubercular etiology.

Lupus has nothing in common with syphilis in any direction. Both diseases may run side by side in the same individual.

DIAGNOSIS.—In the diagnosis of lupus the following main points have to be adhered to:

*A. From the History:*

1. The beginning in early childhood, or before puberty.
2. The very slow, insidious course.

*B. From the Objective Condition:*

1. A new-formation consisting of soft, friable granulation tissue, situated *in* the skin or rising but little above the level of the external surface.
2. The formation of "primary efflorescences" in the neighborhood of older foci; these small, yellowish-brown, easily depressed nodules scattered in the tissue are the most valuable diagnostic sign of lupus.
3. The tardiness of the development from the single lupus nodule to the broader conglomeration of nodules which again requires months to break down into an ulcer.

The discoloration, the desquamation, and the moderate, often quite superficially extended infiltration may, however, give rise to mistakes, namely:

1. With a *chronic eczema* which likewise may last for years and presents circumscribed, dark-brown, desquamating spots.

Differential Diagnosis.

Eczema is firm, dense, offers great resistance to a blunt instrument.

Eczema weeps and deposits superficial crusts, but does not form ulcers connected with loss of substance, hence heals without the formation of cicatrices.

Eczema spreads as a uniform inflammatory infiltration into surrounding parts; lupus, however, always with the formation of isolated nodules scattered in the healthy tissue.

2. With *psoriasis*. Here, of course, only those rare cases enter into the consideration in which disseminated flat patches of lupus exfoliativus are more plentifully distributed, where the infiltration is so slight and extended so superficially as not to be perceptible to the palpating finger and to cause no difference in the level. The pale-red color of the psoriatic patches, the white lustre of the easily detached scales, under which the readily bleeding corium is at once exposed, the more extensive spread, the characteristic localization (especially on the extensor sides of the joints) will furnish adequate guiding points.

3. With *lupus erythematosus*. Here a mistake will hardly be possible; the pale-red, flat, almost imperceptibly infiltrated plaques of L. erythematosus covered with thin, superficial scales of fatty lustre give an altogether different picture from lupus vulgaris, in spite of the generally identical localization in the face.

4. With *rosacea* and *acne*. Here a mistake is more easily possible, owing to the enlargement of the nose occurring in them as in lupus. However, the differential diagnosis will be facilitated by the presence, in acne and rosacea, of a uniform firmness in the elephantiasis-like neoplastic connective tissue, the more intense redness, also by the pustulous character of the rapidly developing acne efflorescences, by the non-implication of the pituitary membrane, by the presence of the small telangiectasiæ perceptible through the skin, and finally by the frequently very profuse seborrhœa. It should be specially noted that the small, reddish efflorescences situated on the cheek in the neighborhood of the diseased portion of the nose, are, in lupus, yellowish-brown formations deposited *within* the tissue; in acne, bright-red, prominent nodules paling under pressure and sometimes suppurating.

In the case of *ulcerous* forms of lupus, the question may arise whether we are not perhaps dealing with a cancroid or with syphilis.

Respecting *epithelioma*, the case would be decided by the great (ivory-like) hardness of the elevated, translucent margins with whitish lustre and of the entire node nesting in the tissue; by the small quantity of secretion; by the development commencing at a more advanced age; by the involvement of the neighboring lymphatic glands; by the great painfulness. It must not be forgotten in this connection that a complication of carcinoma with lupus may occur. Such complicated cases are all the more dangerous because the proliferating cancerous mass finds but little resistance in the lupous tissue.

But still more frequently the question presents itself, *lupus or syphilis?* Even the tubercular, nodular syphilide may be mistaken for lupus, especially when the several nodes are crowded together. The difficulty of the diagnosis, however, is chiefly due to the similarity of the round, peripherally extending ulcerous processes present in both

diseases, as well as to their equal predilection for the nose, cheek, and face. The history, as a rule, is comparatively worthless, whether it points to syphilis or not. In the former case, because lupus coexisting with syphilis presents no striking features; in the latter, because ulcerous syphilis often develops so many years after infection that the credibility of anamnestic data, in case syphilis is denied, is very slight. The differential diagnosis between lupus and ulcerous syphilide is based on the following points:

1. *Form and appearance of the ulcers.* The margins of lupous infiltrations, though sharply demarcated, are low, soft, not infiltrated, blending rather gradually with the bottom of the ulcer. The bottom of the ulcer is lax, red, granulating, smooth, bleeding easily. Pain is slight.

The syphilitic ulcers are very painful. The margins are thick, firm; raised wall-like toward the healthy surroundings by the deposited infiltration, while they descend abruptly and sharply cut toward the bottom of the ulcer. The bottom is irregularly eroded, covered with pus and necrotic shreds of tissue. Hence the crusts upon syphilitic ulcers are much thicker and more prominent than those upon lupus ulcerations.

2. *Environs of the ulcers.* In lupus we find in the neighborhood a soft, friable granulation tissue which at once yields to every mechanical attempt at destruction, while the syphilitic infiltration is distinguished by a peculiar hardness. More peripherally, we find the nodular gummous infiltrations as opposed to the small, impalpable lupus nodules deposited within the tissues. These lupus nodules form the most valuable auxiliary in the diagnosis. They are present in the large majority of cases; otherwise these "primary efflorescences," unless the lupus is in the process of healing, appear in the periphery in the course of several weeks' observation.

3. *Origin.* Lupus as a rule exists from childhood, while syphilis usually is acquired later.

4. *Course.* Every single lupus node, as well as the whole morbid process, has a far more chronic course than syphilitic products. The development of the gummous forms of syphilis is indeed chronic; but whenever ulcerous processes are present, the destruction is rapid, eroding in the space of weeks what lupus would require months or years to break down. The danger of permanent losses of substance connected with ulcerous syphilis makes it our duty, in all doubtful cases, to begin with an antisyphilitic treatment. The latter has no injurious influence upon lupus; while on the other hand an untreated ulcerous syphilis might leave irreparable damage in its train. At any rate, the antisyphilitic treatment in itself furnishes a valuable diagnostic auxiliary. Emplastrum hydrargyri (especially if adhesive), conjoined with the use of potassium iodide, removes recent disintegrating syphilitic nodes in a very short time, while lupus nodes present no appreciable alterations under the plaster.

Particularly in the case of ulcers located on the female genitals the diagnosis of lupus is often very difficult. There is, on the one hand, the possibility of mistaking lupus for the ulcerous syphilide. Neither of these diseases possesses a pathognomonic sign. Both are equally rare on the vulva. Usually lupus occupies a greater surface and extends more deeply, its tendency to assume a circular form is less, and its course is more chronic than ulcerous syphilis. Sometimes we are aided by the scrofulous or syphilitic history, unless we are dealing with a patient who is both syphilitic and scrofulous. Often, as has been stated, nothing remains but to try an antisyphilitic treatment as a test.

On the other hand, lupous ulcers of the genitals may be mistaken for the serpiginous and phagedænic variety of soft chancre. The diagnosis from the objective symptoms will always be very difficult; it is facilitated, however, by the history. The serpiginous

ulcus molle develops in direct connection with the soft chancre. Without any preceding new-formation, the affection from the beginning represents an ulcer which besides, in the first stages, exhibits a far more acute, inflammatory character than lupus, even though lupus of the genitals, especially scrophulide lupiforme de la vulve, is distinguished from all other forms by its more rapid ulceration going hand in hand with destruction and perforation. Eventually, inoculation with the ulcerous secretion will decide; that is to say, it will be ineffectual with lupus, that from chancre will produce another ulcer. It must be borne in mind, however, that experimental inoculation with phagedænic chancroidal secretion may give rise to additional phagedænic chancroids, hence that the danger to the patient from the experiment, *per se*, is not inconsiderable. Finally, in the great majority of cases, besides lupus of the genitals, forms of lupus will also be found on other parts of the body which will be of use in the diagnosis.

Syphilitic ulcerations of the mucous membrane are liable to be mistaken for lupous ulcers which they resemble. But the ulcers of lupus are generally more shallow, shell-shaped losses of substance with soft margins and base, the latter bleeding easily on touch. Here too, the chronic course, the peripheral extension, and the termination of the infiltration in absorption or disintegration will decide when compared with the rapid progress in syphilis.

Treatment.—The treatment will have to aim at two objects: first, to stay the development and progress of the pathogenetic virus: second, to destroy the morbid products already deposited. "It is necessary to remove those portions of tissue which are so diseased that no firm, permanent tissue could be reproduced from them and which, if the patient were left to himself, would have to be destroyed by a slow process of ulceration if healing were to result; in those parts which are still firm and relatively sound, the lupous cellular infiltrations, sometimes diffused, sometimes in patches, must be caused to be absorbed" (Volkmann). To accomplish the former object, we employ internal medication and the local destruction of the virus.

Internal treatment, of course, would then only attain its full value if we had at our disposal a specific capable of destroying the lupus virus. Second in order we would have to consider the medicaments which have a generally roborant influence on the constitution of the body, by which we would increase the power of resistance of the body toward the spreading virus.

As a sort of specific against tuberculosis, iodoform has in the most recent times acquired the greatest recognition. My own experiments had very encouraging results, although direct cure was not attained. Potassium iodide has long been in use against lupus; but at all events it requires to be used for a very long time if it is to have any effect, which appears altogether doubtful. Recognized of old as a specific agent is also cod-liver oil, with or without the addition of pure iodine, creasote, etc. (Ol. jecor. asell., 200 grams [Ol. morrhuæ, ℥ iij.]; with creasoti, 1 gram [gr. xv.] or iodi pur. 0.1 gram [gr. iss.]).

Arsenic in very small doses, iron, and quinine belong to the class of roborants. The general dietetic and hygienic treatment is based on well-known therapeutical principles.

The local removal of the virus, of course, will not be feasible without the destruction of the morbid products already present.

The number of the methods at our disposal for this purpose is very large. The value of each will be dependent upon:

1. The greater or lesser certainty with which the virus can be reached. Here we must not lose sight of the fact that the micro-organisms in question are always present

in the neighborhood of the obviously diseased portions in the midst of apparently healthy parts. The microscopic examination, therefore, is not reliable.

2. Certain æsthetic considerations with regard to the future appearance of the patient, since lupus attacks the face most frequently.

Starting from these points of view, we hold the best treatment to be that with caustics. They are to be preferred to surgical treatment with the knife (excision) or the spoon, or at least to be combined with these methods.

We discard caustic potash, Vienna paste, and Landolfi's paste, because their action is incalculably deep also on the healthy skin and leaves dense, hard, unsightly cicatrices. Better is Cosme's paste as modified by Hebra (composed of white arsenic, artificial cinnabar, and fat), because it does not destroy the healthy skin. But after several days' application, inflammatory swelling and great pain result. Besides, there is danger of causing intoxication by the arsenic contained in the paste. Cauterization with the stick of silver nitrate has comparatively little effect. The healthy tissue offers sufficient resistance to the silver, and even in the diseased portions the caustic effect does not spread beyond the spots purposely touched.

The best seems to me to be pyrogallic acid. This acid destroys all lupus tissue and spares the healthy skin altogether. It penetrates into the tissue and is better able chemically to find the morbid patches in apparently normal structures than the eye of the observer. The probability of reaching the peripherally proliferating virus is therefore greater, even though this be not attained by the first application. Withal the cicatrices forming from the ulcers due to the employment of this caustic are very sightly, soft, smooth, because the healthy portions within the lupus patch, having been spared, are utilized in the cicatricial process.

The danger of intoxication is minimal, because the absorptive surfaces are too small to bring a sufficient quantity of pyrogallic acid at once into the organism.

Pyrogallic acid is best applied in the form of a ten-per-cent ointment spread upon linen. The linen rag, covered with gummed paper and tied as firmly as possibly on the diseased surface, is changed morning and evening for three or four days. During this time it will be noticed that the softening masses of tissue become gradually browner and finally black (by the contact of the pyrogallic acid with alkaline tissues), until by the end of the third or fourth day a black discolored deposit lies upon the surface. Thereby our object has been reached: the diseased neoplastic foci are destroyed to a great extent, as far as the pyrogallic acid has been able to penetrate. The surrounding skin usually shows, aside from the blackish-brown discoloration, only an insignificant inflammatory swelling; only rarely will a vesicular detachment of the uppermost epidermal layers be observed. The pain, too, is slight; it begins as late as the third or fourth day, and continues only when the mortified ulcerous surface is left uncovered. The pulpy masses are then mechanically removed as much as feasible and an ointment dressing applied. We employ as an after-dressing a Lister's carbolic or thymol dressing, or rather one of iodoform ointment: an ample layer of powder is dusted on and covered with ten-per-cent iodoform ointment, or the anointed piece of linen alone is laid over it. Besides the (possibly present) specific antituberculous action of iodoform, its disinfectant and anæsthetic effects assert themselves. The cauterized portions become covered with skin in from one to three weeks. It is only rarely, of course, that a single three-days' application suffices to effect a cure; usually the course must be repeated; but in that case the cicatrix previously obtained is spared by the pyrogallic acid and merely the additional or formerly left lupous foci are softened.

Alcoholic or watery solutions of pyrogallic acid, as well as its employment in the form of ether spray, have not proved equally effective. The spray will be applicable only for lupus of the nasal cavity. Böck employs a pyrogallus plaster: Ol. olivar., Resin. coloph., āā 8 grams; Ceræ flavæ, 15 grams; Gummi resinæ ammoniaci, Balsami terebinth. venet., āā 1 gram; Acid. pyrogallic., 4 grams. M. ft. empl. The plaster acts more uniformly than the ointment and is somewhat less painful.

In a few cases, perhaps, the employment of pyrogallic acid could be combined with other procedures. For instance, scraping may have to be done previous to the application of pyrogallic acid; in the case of thick epidermal layers it will eventually be necessary to soften them by energetic washing with potash soap or by painting them with potash lye, and render them more permeable. For slightly ulcerating forms of lupus, chrysarobin may also be taken into consideration (1 : 4 ointment).

Starting from a similar point of view as Jarisch, Riehl recommended the direct application of iodoform for lupus. While formerly the treatment of lupus had been confined to the destruction and removal of the lupous infiltration, he believed that he had found in iodoform a remedy which was followed by gradual absorption and alteration of the lupous tissues.

My experiments in this direction yielded exceedingly satisfactory results. Ulcerating lupus nodes were covered with iodoform to a thickness of about one to three millimetres (simple painting with iodoformed glycerin or collodion produces no effect), whereupon the suppuration stopped at once and the infiltration disappeared.

For more deep-seated infiltrations the following preparatory treatment was employed: The diseased skin, previously freed from fat by washing with soap, was painted by means of a charpie brush with a solution of caustic potash (5 parts) in distilled water (10 parts) and left in contact with it until the epidermis over all the diseased parts was translucent, macerated, and detached; then by swabbing with charpie dipped in water the superfluous caustic potash was removed, and the part dried. The surface was then dusted with finely powdered iodoform to a thickness of one to two millimetres, and bandaged with wadding and strips of adhesive plaster. The dressing was allowed to remain for three to eight days.

In no case was there any suppuration; the iodoform had sunk into the depression formed by the disappearance of the lupus tissue; the intervening skin was pale and pliable; the swelling and erythema had largely disappeared. In very intense cases, the application had to be repeated two or three times.

The procedure, which causes pain only during the cauterization with potash, is convenient, inexpensive, rapid, and effective.

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With regard to the purely mechanical methods of treatment, I wish to quote a few words of Volkmann's. He says: "It must be admitted that much more depends on *how* these various measures are employed than on which particular agent is chosen. The treatment of lupus is one of the numerous chapters of our art in which a great deal depends upon an accurately matured technique and method."

Among the mechanical methods, the most *radical* is excision. However, aside from the deep cicatrices left over, and the necessity of being obliged to operate in the healthy tissue, it offers no greater security as regards permanent cure than other methods. It can be recommended only when, owing to a plastic operation which is to follow immediately, the conditions are rendered more favorable by excision. Similar advantages,

though also serious disadvantages, are offered by the employment of Volkmann's sharp spoon. It is well known that healthy tissue does not yield to its pressure, while lupus tissue can be removed without difficulty, that is, so far as the at best coarse instrument can penetrate into the tissue. Hence we need not fear the removal of healthy tissues. After scraping away the lax granulations, an almost fibrous tissue is laid bare, which gradually cicatrizes. Pain and hemorrhage are comparatively slight. In this case, too, the after-treatment is advantageously inaugurated with iodoform; we have stated above that it is often advisable to follow the mechanical removal by the use of a caustic agent (pyrogallic acid). The spoon is specially applicable to the removal of lupus masses from the nasal cavities, to be followed by the employment of the iodoformed ether or pyrogallic acid spray.

For the removal of lupous infiltrations only, the following additional methods are in use.

1. Scarification, *i. e.*, multiple stabbing, linear scarification having been substituted for the punctiform scarification.

By the multiple incision of the capillaries, great anæmia of the patch is suddenly produced, while the neoplasm itself is mechanically destroyed with preservation of the cutaneous investment, and thus to a certain extent the progress of the lesion is interfered with. This method is applicable in all but the ulcerative forms of lupus. Volkmann recommends it wherever the parts are either diffusely affected with lupus or at least abormally swollen and vascularized, as well as in the forms unattended at first with the formation of ulcers; also for the removal of the livid spots remaining on and around the scraped portions, and which tend largely to produce relapses. The procedure itself is very simple. With a sharply pointed two-edged knife or, better, with an instrument having a number of fine parallel blades resembling hair-pins, the patch is superficially incised by a straight cut. The depth of the incisions depends upon the facility with which the instrument penetrates the tissue. The pain in general is rather moderate, so that local anæsthesia is seldom called for. The bleeding can be controlled by simple compression with a sponge or by the application of agaric. Each scarification is followed by a light ointment or similar dressing. After a week the procedure may be repeated, the incision being made at right angles to the previous one. The frequency of scarifications depends mainly on the extent of the lupus; even if healing has been secured, very careful supervision will be necessary in order to either prevent or at once remove relapses.

Volkmann prefers scarification to all other methods. "Thus far," he writes, "no lupus has resisted this method, and in the majority of cases healing resulted exceedingly rapidly." Hence he does not hesitate to finish the treatment with a plastic operation immediately after the healing of the lupus ulcers. If necessary, he even transplants portions of skin affected with lupus, in order to attack the disease subsequently at its new location.

Next in effectiveness is the galvano-caustic method. One advantage is the avoidance of hemorrhage; another the comparatively slight painfulness, especially at white heat. A disadvantage is the fact that both healthy and diseased tissue equally suffer combustion.

The effect of mechanical destruction with a caustic action is combined in the solid stick of silver nitrate. It is pointed, and inserted into single nodules and larger infiltrations, and then bored into the healthy tissue in various directions. Here the normal structures offer sufficient resistance, so that only the morbid tissue is removed. The application of the stick, in itself rather painful, is usually followed by a harassing

inflammatory swelling which does not go down until after several hours. Hence the treatment can be repeated only at intervals of two or three days. The cicatrices are flat and soft, without any tumefaction. This procedure is specially appropriate for isolated nodules in the shape of relapses, or in the periphery of larger patches of lupus. It is also applicable for the first removal of lupus granulations on mucous membranes; later, it is better to substitute for it concentrated solutions (with equal parts of distilled water), which penetrate more deeply into the tissue.

The sticks of caustic for this purpose must be hard and firm, such as are produced by melting them with potassic nitrate (lunar caustic).

Besides, the scarification has been combined with the injection of destructive liquids. Auspitz dips the point he had attached to Volkmann's spoon into a glycerin solution of iodine (iodi pur., 1 part; glycerini, 20 parts), previous to every insertion of the scarificator, whereby he secures a more rapid healing and diminished painfulness. Schiff attached a small rubber pipette to a short injecting needle, so as to enable him to make an instantaneous injection with every thrust.

In order to hasten the absorption of the lupus proliferations, a good adhesive emplastrum hydrargyri is employed (or regular inunction with gray ointment), or painting with tincture of iodine or iodized glycerin (Iodi puri, Potassii iodidi, āā 5 grams; Glycerini, 10 grams). The diseased parts are painted morning and evening for several days in succession until crusts form, the evaporation of the iodine being prevented by the application of paraffin paper. Then the crusts are detached, and the procedure is repeated.

In ulcerous forms, besides the strong silver nitrate solution, it is recommended to use a solution of salicylic acid in glycerin (6 : 20), to be painted on three times daily. It is said also that the dusting of pure salicylic acid in powder causes the readily bleeding vegetations to wither and the ulcer to cicatrize rapidly.

But no matter what method be employed, we must invariably be prepared for a prolonged course of treatment, and it will always be necessary to carefully remove relapses and newly developed infiltrations. The patients require regular, unintermitting medical supervision for years. In some very advanced cases, it may perhaps be well to abstain from any interference. At present I have under observation a lady patient who has suffered for about twenty-two years from lupus of the right forearm and hand without having had any treatment. The entire forearm is one lupus surface; the palm of the hand is also interspersed with closely packed patches of lupus. When these patches are probed with the sound, the latter penetrates in all directions, without meeting any resistance, almost as far as the dorsal surface of the metacarpus. Therefore, it must appear questionable whether any therapeutic procedure, by excessive destruction, would not more seriously and earlier cripple the mobility of the still useful member than if the process be left to itself.

In many a case even amputation must be resorted to.

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I here append a brief note on

## THE SARTIAN DISEASE

(*Taschkent-Geschwür, Paschachurda, Jaman Dscharagan*)

which was published by Dr. Heiman in the *Gazeta lekarska*, No. 39, Warsaw, and reprinted in the *Deutsch. medic. Wochenschr.*, No. 3, 1883.

The Sartian disease, an endemic cutaneous affection of the inhabitants of Taschkent and its en-

virons, especially along the borders of the rivulet Tschirtschik, has been studied in its patho-anatomical relations by Prof. M. Rudniew.

According to the statement of the Sartians, the disease has existed in Taschkent for four hundred years, is hereditary, occurring also in persons domiciled elsewhere, but whose parents have had the disease in Taschkent; it owes its origin to drinking the water of the rivulet Tschirtschik, hence can originate only among the inhabitants of Taschkent, but is transmissible from them to other people; it never attacks the same person a second time.

The affection is most frequent in the face, especially on the forehead and the temples, more rarely on the lips, nose, lower jaw, auricle, most rarely on the eyelids; next in order of frequency, on the upper and lower extremities, the neck, and the trunk: never on hairy parts, nor on the palm of the hand and sole of the foot. It begins without any prodromata as a rose-red spot, the color of which soon changes into dark-red, yellow, or bluish; it is of round, oval, or irregular shape, sharply demarcated from the surrounding skin; it occurs either isolated or on several places at the same time. The size of the spots varies from that of a pin's head to that of a kopeck and larger.

At first the redness disappears under pressure, later it persists, the skin gradually becomes indurated, then acquires a smooth feel, later it grows rough, and, when the nodules approach one another, makes the impression of a wart. The nodules develop either simultaneously or periodically, in which latter case the more recent ones surround the older in a circle. With the occurrence of the nodules, desquamation of the epidermis begins and becomes more and more intense as the newly-formed epidermis is of more recent origin. As a rule, the nodules finally coalesce into a diffuse node of coppery or livid color. This hyperplastic stage may last from two to eighteen months.

Then the ulcerous stage commences, the several nodules breaking down from the centre toward the periphery, and finally represent a large ulcer with uneven bottom, and semifluid, sticky, grayish-yellow secretion, which gradually dries into yellowish-brown crusts. If crust-formation should not occur, the development of nodules extends peripherally, the bottom of the ulcer is then smooth, while the margins are uneven and sometimes undermined. Under inappropriate treatment the corium may disintegrate. Otherwise, or in spontaneous limitation of the process under the crusts, granulations form, which, according to the duration of the ulcerous disintegration of the several nodules, develop in the form of small islands. Finally the granulations become covered with epidermis, and there is formed a depressed, radiating or net-like, more rarely a smooth cicatrix. At times cicatrization takes place in the centre, while the process progresses at the periphery, which gives rise to considerable disfigurement. Only in children restitution *ad integrum* of the skin takes place; in a favorable case, discolorations remain behind.

The course is painless, and at most causes cutaneous itching. Young persons, up to the fiftieth year of life, are most frequently attacked. Relapses are exceedingly rare and never occur at the former seat.

According to Rudniew, the affection is a granuloma, the elements of which possess a considerable degree of permanence, and which develops in the substance of the corium. At first we notice a more copious vascularization in the papillary and reticular tissue. Then, along the dilated vessels small cells develop with very delicately-outlined nuclei and finely granular protoplasm, without any intercellular tissue; they rise up to the epidermis layer and effect its disintegration. The ulcerous destruction of the corium itself never extends as far as the subcutaneous connective tissue.

The Taschkent ulcer is distinguished from *lupus* by being spread diffusely over the skin, and never attacking the mucous membranes, by causing no reaction in contiguous parts, by having a shorter course and ending in spontaneous recovery, without impairing the general nutrition.

Tubercular *leprosy* differs from the Taschkent ulcer, aside from the painfulness of the nodes and the extension to bone and cartilage, by its duration and incurability.

Mistaking it for *syphilis* is prevented by the history and the slow course, especially the late occurrence of disintegration, finally the ineffectiveness of antisyphilitic treatment. The best results are obtained from cauterization with Canquoin's paste, caustic potassa, solid nitrate of silver, and chloride of zinc paste.

E. Polak, who had studied the affection as long ago as 1860 (*Wien. Med. Zeit.*, Nos. 48, 49), has recently again declared that the Taschkent ulcer is nothing but the so-called Haleb-node, bouton d'Alepp, or the Biskra and Delhi bubo.

## II. LEPROSY, LEPRA.

Leprosy is a parasitic disease of chronic course; it consists in the development of more or less circscribed inflammatory new-formations, mainly in the skin and in the connective tissue of the peripheral nerves. The disease is almost invariably incurable, without being the direct cause of death.

According to its localization, two great groups of symptoms arise, cutaneous or nervous, which have of old led to the erection of two different forms of leprosy—forms, however, which but rarely develop in complete purity.

Leprosy of the *skin* is called *Lepra tuberculosa* s. tuberosa, s. nodosa, tubercular leprosy. Leprosy of the *nerves*, lepra nervorum, has received its titles from the most prominent symptoms: *L. anæsthetica s. glabra s. mutilans*, etc. Between the two lie the *mixed forms;* consisting mostly in cutaneous eruptions, to which the symptoms dependent on the alteration of the nerves become superadded; more rarely the reverse occurs, the cutaneous symptoms succeeding the pronounced L. nervorum.

### SPECIAL PATHOLOGY.

#### 1. *Lepra Tuberculosa; Lepra Cutanea.*

Although it is impossible to ascertain the date of the infection, a series of general morbid phenomena appears almost constantly which may be termed *prodromal* (premonitory symptoms)—symptoms not materially differing from those observed in other infectious diseases. There are gastric disturbances, anorexia, dyspepsia; great fatigue and somnolence, with intense vertigo, appear; they become associated with profuse sweats and frequently violent epistaxis. But the most important are attacks of pyrexia, sometimes of an intermittent, sometimes of quite irregular character. These symptoms, occurring at variable intervals and in different intensity, may precede the outbreak of the disease for months, even one or two years.

Those authors who had frequent opportunities of observing the onset of the diseas designate the premonitory fever as a constant symptom.

The prodromal stage is followed by the *eruptive stage*, initiated by an erythematous exanthem of gradual origin and spread, *i. e.*, more or less deep-red spots which have a special predilection for the face, and next for the extremities; they are darker in the centre than at the periphery, may be of any size, and usually project uniformly above the level of the normal skin. Frequently the spots are slightly hyperæsthetic in their first stages or cause a certain feeling of itching. This macular form either disappears, leaving inconsiderable remnants of pigment, or else from these brownish-red spots spring tubercular neoplasms of nodular or more band-like form; often they can be felt in the depth long before, in the shape of nodular infiltrations. They sometimes spread peripherally, others grow in height; contiguous neoplasms become confluent, thus giving rise to gradual extensive infiltrations. As a rule, this process requires many months or years before the macules change into tubercles and diffuse infiltrations, or until the small, at first barely perceptible infiltrations in the corium will clearly project above the level of the skin in the shape of tubercular efflorescences.

In the further course of the disease we must follow, on the one hand, the future fate of every single node; on the other, the perpetual and irrepressible outbreak of the leprous new-formation on additional regions.

The individual nodules enlarge and appear as dark-red, soft formations; for month

they remain unchanged, at most assuming a more yellowish-brown color. The epidermis desquamates slightly, becomes rough, but is preserved. More acute necroses in the central portions of the tubercles, leading to softening, to gradual thinning of the covering layers of epidermis, and thus to shallow ulcerations, are not regular, but merely traceable to external influences. These ulcers are quite indolent, have sharply cut edges, and secrete copious quantities of thin pus from their rather smooth, badly granulating bottom. Having a slight tendency to recovery, they cicatrize only after having existed for a long time. The original hyperæsthesia of the tubercles soon gives way to a steadily increasing anæsthesia ; the remaining thin flat cicatrices are usually entirely devoid of sensibility. At times, too, the tuberous eruptions vanish quite acutely with the appearance on the region in question of an erysipelas.

The parts most affected are : face and forehead, eyebrows, nasal and oral mucous

Fig. 22.—After a photograph sent me by Dr. Goldschmidt, of Funchal (Madeira).

membranes. On the extremities the points of predilection are : extensor surfaces of the knee and elbow joints, the dorsal surfaces of the hands and fingers ; altogether the extensor more than the flexor surface. Every part of the body, however, may be attacked, except the scalp and the glans penis. The affected parts, of course, have their volume very materially increased, and the mobility of some limbs, for instance the fingers, is seriously interfered with ; this is especially the case when the above-mentioned ulcerations establish themselves at these particularly exposed places. Quite typical, however, is the alteration of the face : by the diffuse deposition of the leprous neoplastic mass upon which secondary nodes and excrescences are again superimposed, broad wheals are produced which bulge out especially the frontal and supra-orbital regions ; the cheeks gradually form thick, pillow-like protuberances on both sides of the infiltrated and nodulated, but broadened and flattened, depressed nose.

The upper lip is bloated and tumid, with slight ectropion. Withal there is more or less local alopecia of the eyebrows and the beard. The auricles grow thick, especially the lobes change into sacs sprinkled with nodes. Under the chin, itself bloated and pendulous, the voluminous groups of infiltrated lymphatic glands project. Through these slow but steadily advancing processes a physiognomy is produced which is marked by lack of expression, and naturally leads to a notable resemblance of all lepers. The immense tumefaction, especially the frontal and supra-orbital folds hanging often sac-like over the eyes, have given rise to the term, facies leontina.

The alterations in the mucous membranes of the mouth, the nose, the palate, and the pharynx down to the larynx, run parallel to those of the skin. Infiltration and node-formation lead to gradual thickening. Even in the early stages we meet with ulcerations covered with corresponding crusts, especially in the nose, the calibre of which is lessened thereby, leading to snuffling inspiration. Through similar processes on the laryngeal mucous membrane the voice becomes harsh and toneless. But as the leprous infiltration extends also into the cartilage, deeper destructions are also produced ; it erodes the nasal vault which sinks in ; in the larynx it causes ulcerous losses of tissue which lead to absolute aphonia and often to stenoses which endanger life.

With the above are associated yellowish, flat deposits in the conjunctiva which gradually extend as a white opacity from one edge into the cornea, more and more reducing the visual power, until finally total opacity of the cornea, or its ulcerous perforation with loss of the lens, causes permanent blindness.

The glands, especially those of the submaxillary, cervical, and inguinal regions, increase so enormously in size as to be conspicuous at first sight in the shape of tubercles as large as an apple.

In reference to the other organs, we have to note as characteristic only a gradual atrophy of the testicles. Should the disease begin before puberty, the physical development, especially that of the genitals (with the alteration of the voice, etc., dependent upon these processes), is greatly retarded. The mental faculties are not deteriorated ; the subjective condition is generally good, unless complications ensue in the shape of febrile attacks, or paroxysms of pain such as occur with the implication of the peripheral nerves.

The extension of the process takes place either by the slow peripheral growth of existing patches and the formation of isolated nodes close to older infiltrations, or else a larger region is attacked with an acute eruption of many neoplastic foci. This last modus proceeds in the shape of an erysipelas. With considerable rise of temperature conjoined with headache, arthralgia, thirst and nausea, great debility and depression, the face and neck, or an entire extremity, become pretty uniformly turgescent, the skin reddened, very sensitive, at times exceedingly painful. At the same time the corresponding lymphatic glands swell and give pain. After a few days all these symptoms abate, and then we observe the eruptions in larger numbers, developing either as macules or as flat infiltrations. Often the same region is attacked several times in succession. In other cases there is no erysipelatous participation of larger portions of the skin ; circumscribed deep infiltrations (comparable to erythema nodosum) form, which by-and-by prove to be fresh leprous neoplasms.

However, attacks of fever without such eruptions also occur ; they have been referred partly to metastatic invasions of other organs, partly to the absorption of softened masses of tubercle. But at all events these pyrexial periods are always a sign of the in-

crease of the disease. The patients dread these paroxysms very much, because a residual great weakness frequently keeps them confined to the bed for weeks.

The type of the fever is not quite constant, now irregular, again remittent; oftenest we find the intermittent type, owing to which fact intermittent fever is given in the history of a great many patients. For instance, in a case (from Surinam) observed by myself here at Breslau, this intermittent character is present; regularly at two o'clock P.M. on the respective days the temperature rises to 39.5° C. (103° F.), becoming almost normal at night. The pyrexial attacks each time go hand in hand with fresh eruptions.

This in brief is the course of cutaneous leprosy. We have seen that after a variable period of incubation associated with involvement of the general organism, the local processes develop on the skin, mucous membranes, in the glands, testicles, the tissues of the eye, etc., sometimes in acute progression within a few years, again chronically extending over decades with periodical eruptions separated by long intervals. To these are almost regularly superadded affections of the peripheral nerves.

The leprous character has not been positively demonstrated in the diseases of internal organs frequently found at the autopsies of leprous patients. It requires only brief mention here that, in the liver, cirrhosis with the presence of bacilli has been demonstrated by myself and later by Cornil. In the spleen (Norway), bacilli have been demonstrated by Hansen and subsequently by myself.

The course of tubercular leprosy in general is very unfavorable. Although the disease does not always form the direct cause of death, recoveries are very rarely observed. Hillis tabulates the following causes of death:

| | |
|---|---|
| Nephritis, | 22.5% |
| Pulmonary disease, including phthisis, | 17. % |
| Diarrhœa, | 10. % |
| Anæmia, | 5. % |
| "Remittent fever," | 5. % |
| Peritonitis, | 2.5% |
| Exhaustion by leprous ulcerations; leprous stenoses of the air passages; lepra of internal organs, marasmus, atrophy; in short, direct consequence of leprosy, | 38. % |
| | 100. % |

The same author also calculates from the mortuary records of his leprous material (in the West Indies) that the duration of life of tubercular leprosy patients is considerably shorter than in those of the anæsthetic form (20% to 10% of mortality).

Experience shows that the prognosis becomes better when lepers immigrate into countries free from the disease. Although the process is very rarely completely arrested, it usually is evidently prolonged.

### *II. Lepra nervorum* (*Virchow*).

Here likewise prodromal symptoms precede the obvious outbreak of the malady; they are from the outset of a more nervous character: great sensitiveness in various parts of the body, resembling rheumatism, a sort of hyperæsthesia of the entire skin; dull, often lancinating, boring pains along the track of certain nerve-trunks, especially the median, ulnar, and peroneal nerves; pressure greatly increases the pain; gastric symptoms are also often mentioned.

After this period, lasting about a year, the disease develops in a very chronic course,

until it finally reaches a stage of stability in which we can hardly speak of an evident progress of the affection. This tardiness and indistinctness of development is a principal characteristic of the malady; the several stages merge into each other without any clear demarcation. Therefore the erection of a "prodromal" stage is really unjustifiable, for the premonitory symptoms are, strictly speaking, symptoms of the actual disease.

The morbid process of lepra nervorum is an inflammatory one, of rather acute onset and rapid course, in the interstitial connective tissue, leading by degrees to connective-tissue neoplasia with corresponding atrophy of the nervous elements.

Accordingly we shall be able to form two larger groups of symptoms:

A. Such as are directly traceable to the affected nerve.

B. Such as occur in corresponding parts of tissue in consequence of this nervous disease.

In the COURSE of the affection, however, three periods (more or less clearly demarcated in a concrete case) will be distinguishable:

1. Prodromal stage: period of the developing neuritis.

2. Eruptive stage: in which the symptoms of nervous disease become clearly perceptible.

3. Permanent stage (completed atrophy).

The symptoms occurring in each of these stages are of a motor, sensory, and trophic nature.

1. Direct motor symptoms only with purely motor nerves. With these alone we find true muscular paralyses. In the affections of the mixed nerves the motor fibres remain intact.

2. Sensory symptoms.—Disturbances of the tactile sensation go hand in hand with those of the perception of pain until both are totally lost.

3. Trophic symptoms:

*a*. Of the skin. They occur mostly in the first, more acute period of the nervous affection and consist:

1. In the development of bullous eruptions resembling pemphigus.

2. In pigment anomalies, the pigment being either increased or lost.

3. In atrophic processes (glossy skin, etc.) belonging to the later period.

*b*. Of the muscles, which atrophy, with correspondingly impaired motility.

*c*. Of the bones and joints, leading to the loss of phalanges, etc.; here, of course, the influence of external traumata on the absolutely insensible portions of the body must be taken into consideration.

In the main, therefore, the qualities peculiar to leprous neuritis correspond with the description given in neuro-pathological text-books of neuritis in general, only in leprosy the acute and chronic forms are more blended together.

Entering now more closely on the symptomalogy, we find, in the beginning of the disease, chills, now and then rigors with fever; furthermore, violent pain, felt usually not only in the distribution of the affected nerve, but in the whole limb which frequently is slightly swollen and erythematous. The skin is then hyperæsthetic. Still more constant are subjective symptoms such as formication, numbness, torpor, a decided sensation of heat deep down, etc. The pains are persistent, nearly equal by day and by night, and of a lancinating character. The patients are greatly reduced by the consequent loss of sleep.

Hillis holds these attacks of lancinating pain to be as characteristic prodromata of lepra nervorum as the fever eruptions form a pathognomonic initial symptom of tubercular leprosy. H. states he has never failed to observe this, although it was very variable

in degree. Still another phenomenon he describes as specially significant: the patients cannot grasp as firmly with their hands, allowing objects to drop. This motor weakness manifests itself at times as a tremor of single, specially attacked extremities.

In the mean time remissions occur for whole days until a fresh attack of pain reminds the patients of their disease.

The nerve itself is very sensitive to pressure. Anatomically the nerve is frequently palpable through the skin as a thickened cord. In this early stage it exceeds in thickness the swellings which develop permanently in the further course of the disease.

The farther the affection progresses, the more the neuralgic symptoms disappear.

The nerves lose their spontaneous sensibility and that to pressure; the sensations formerly producible eccentrically by compression—pain, formication, numbness, etc.—cease; the cordiform swelling of the ulnar or popliteal nerves becomes ever firmer. Anatomically we find a thickening, usually extended over considerable distances, of the nerve the sheath of which is usually adherent to the surrounding connective tissue. Most conspicuous and constant are the spindle-shaped swellings, reaching the thickness of the little finger, of the ulnar nerve on the extensor side of the elbow-joint. A transverse section shows even macroscopically that there is a deposition of wavy connective tissue which by degrees, often only after the course of years, leads to total atrophy of the nerve bundles and degeneration of the peripheral fibres.

The complex of symptoms corresponding to this stage is exceedingly interesting. I shall have to restrict myself here to giving a sketch of it in a more schematic way; mainly because of the uncommonly great variability with which the several symptoms unite into one whole.

### 1. *Motor Paralyses*

Affect only pure motor nerves, and are witnessed most frequently on the facial branches of the facial nerve. Purely motor pareses and paralyses are found also on the hand and on the feet.

### 2. *Disturbances of Sensibility.*

They form the most prominent symptom. In a gradual transition, the subjective painfulness and "hyperæsthesia" changes into a steadily increasing, finally complete anæsthesia affecting all sensory qualities to an equal degree. As to the tactile sensation, I briefly mention the following:

1. The certainty of localization is lost. 2. The quality of the object touched (form, sharpness, etc.) is not recognized. Stroking, stinging, pressing are not differentiated. 3. The examination with the æsthesiometer shows that the distance of the two points must exceed the normal to a very notable degree in order to make them distinctly perceptible. It is a very surprising circumstance that, in zones where a single point is clearly recognized, both together are perceived as a single, broad, pressing surface. On attempting to excite sensation by light stroking between the two points (felt as one mass), this not rarely succeeds. 4. At times, touches which are not felt at a single trial, are perceived on repeated tests. 5. The conduction of sensation is greatly retarded. This symptom becomes particularly obvious if a still sensible point be touched, and the patient be directed to state when the instrument is removed.

All these tests refer to light touches of the skin. Whenever the pressure employed becomes more intense, the statements are more positive.

Finally the skin (together with the parts underneath) loses all perceptive power of

pressure. The patients do not recognize any object placed in their hands; often they do not even know whether they still have it between their fingers or not.

The sensations of temperature, pressure, and sensibility to pain suffer accordingly. Like the tactile sensation, the latter is also lost first on the skin, later on the bones, muscles, etc.

Excisions, burns, etc., therefore, are not felt by the patients—a fact which in part explains the ulcerations to be described hereafter.

In this section I have made no mention of a hyperæsthesia preceding the anæsthesia because it has been already enumerated as a symptom of the beginnning interstitial neuritic process.

*Anatomically*, the examination of the skin during this (anæsthetic) stage shows no characteristic condition. I am unable, from lack of material, to furnish any information about the presence or absence of the intra-epithelial nerve termini recently described by Unna.

3. *Trophic Disturbances.*

A. *Of the skin.*—Although they, in a general way, run parallel with the sensory alterations as regards the time of their occurrence, location, spread, etc., still there is no connection in the details between the two series of symptoms. Both are co-effects of the same nervous affection. We may distinguish two stages—an early one, marked by the more copious development of all the phenomena to be described; a later one, in which fresh processes appear but rarely and isolated—still, this is an artificial division, as will be evident at once. For in the beginning the disease affects an altogether healthy body, in which it can produce many eruptions synchronously or in rapid succession; while subsequently only isolated regions are capable of being affected. A division into early and late stages is admissible only in so far as the eruptive stage can be separated from that in which the atrophic processes are fully developed and remain stable.

*a.* The *bullous eruptions.*—Without any known external noxa, suddenly and so rapidly that usually only the completed process comes under observation, bullæ appear on the skin; mostly but one, rarely several at once; their size ranges from that of a lentil to that of the palm of the hand; their contents are clear, bright yellow; they persist a few hours or days, break, and form a more or less superficial excoriation, which heals with a correspondingly deep cicatrization and pigmentation (formation of sometimes dark, sometimes non-pigmented maculæ). Owing to the great resemblance of these eruptions to pemphigus vulgaris, they have been termed pemphigus leprosus.

This pemphigus I interpret as a tropho-neurosis, dependent on the irritative effects exerted on the (trophic) nerve-fibres by the commencing interstitial neuritis through the developing neoplasm. Hence we find these bullæ frequently in the first stages of the disease, later much more rarely: for this reason we find them on the hyperæsthetic, painful regions, connected (co-ordinated) with the entire complex of symptoms of acute neuritis. For the same reason, a place formerly covered by a bleb will often exhibit anæsthesia soon, namely, when the compression in the nerve-trunk acts simultaneously on the trophic and the sensory fibres. As the anæsthesia is brought about by atrophy of nerve-fibre, and the bullous eruption by an irritant effect, it is clear that the latter must usually precede the former. The bullæ appear on the anæsthetic skin much less frequently.

The picture of ordinary pemphigus in isolated cases can be altered by inflammatory processes supervening from without, in consequence of which there may be deeper ulcerations, thicker crusts, and denser cicatrization.

*b. Pigment Changes.*—Sometimes these processes are erected into a special form of leprosy (lepra maculosa), sometimes they are separated and distributed among several chapters. Moreover, these alterations produce quite different appearances in the white and the colored races.

In the main we encounter:

*α.* The occurrence of abnormal pigment.—Yellowish-brown to somewhat reddish spots appear; they are either quite flat or rise slightly above the surface; either smooth or with branny, very insignificant desquamation; either sharply demarcated or diffusely merged into the surroundings. The spots have a very variable size, partly no larger than small coins, partly occupying more extensive regions; also spreading toward the periphery, when the centre may change its color and grow pale again. The margin is then often raised to a low wall and of fresher red color. Usually the pigmentations persist for years unchanged. The degree of pigmentation in a concrete case is very variable; the light-brown may give way to an ashy-gray blackish tint.

*β.* The formation of white, quite unpigmented spots, developing either from formerly abnormally pigmented or from the normal skin. The latter seems to be of rarer occurrence. The process corresponds altogether with ordinary leucopathy. In regard to these pigmentations, it should be noted by the way that they are to be differentiated from the spots mentioned above as the initial stage of the tubercular eruption.

Following J. Hillis' description, I here place both forms side by side.

| *Lepra nervorum.* | *Lepra tuberculosa.* |
|---|---|
| The spots do not fade under pressure. They are oval in shape and usually symmetrical in arrangement; more numerous; lighter in color; not elevated at first, later with wall-like margins; at the outset small, gradually enlarging, and sometimes coalescing into large surfaces. They persist as long as the disease, and do not form the precursors of other eruptions. They are to be interpreted as local atrophic processes, and lead also to the loss of pigment in the hair situated within their confines. They arise without fever. They are usually situated on the dorsum of the body. | The spots fade under pressure, are usually round, not symmetrical, of decided red color; they project above the level of the skin with non-elevated margins. They may disappear or become smaller; the local erythema changes into an exanthem. There is no tendency to a peripheral enlargement. The hairs fall from the affected spots without other alterations. Their appearance is regularly associated with fever; they predominate on the anterior surface of the body. |

It is necessary to state quite explicitly that most of the cutaneous alterations designated as morphæa (alba, lardacea, etc.) and enumerated as symptoms of lepra have nothing in common with this disease. This is true also of some circumscribed atrophies of the skin, which Kaposi, for instance, includes under leprosy.

*γ.* To be interpreted as atrophic conditions (as symptoms of lepra nervorum), however, are certainly the degeneration of the sweat-glands on the affected regions with cessation of secretion; also the shrinking and thinning of the skin on the hands, forearms, etc., occurring in the terminal stages; finally the exfoliation and breaking-down of the nails.

B. *Trophic Disturbances of the Muscles.*—These processes running their course in muscles must be termed the most conspicuous symptoms. Clinically they consist in a steadily advancing and finally complete loss of capacity for action of the muscles. The motor power decreases with the atrophy of the muscular tissue. Through the microscope we ascertain that there is here not only a simple atrophy of the contractile substance,

but at the same time proliferations of the interstitial connective tissue. The transverse striation becoming less distinct, and particularly more delicate, we demonstrate swelling and increase of the nuclei of the muscle corpuscles, small accumulations of from six to eight nuclei taking the place of a single one. The interstitial connective-tissue processes begin with the aggregation of cellular elements; subsequently we find only more copious wavy connective tissue between the ever sparser muscles, and finally an interstitial deposition of numerous fat-cells. According to my examinations, a fatty metamorphosis of the muscular substance *per se* does not occur.

The atrophies in question affect in the first place the muscular structure of the hypothenar, then the thenar eminence, the interossei, furthermore the deltoid and quadriceps cruris, the muscles of the calf and face. Mimetic expression disappears; the folds of the face are distorted by the contraction of isolated, non-atrophied muscular trabeculæ. The eyes can no longer be closed, on the one hand on account of the pendulousness of the lower lid, on the other because of the disappearance of the muscles. The globe itself suffers under these alterations; tears flow, ulcerations of the cornea occur. The lips become flabby, the lower one drops away from the gums and allows the saliva to escape.

The hands, incapable of any activity, are clawed by the greater power of the flexors. The gait is slow, dragging; the thighs can be lifted but slightly forward; and the toes always scrape along the floor.

Finally all motion of the extremities becomes impossible, and therewith commences an exceedingly deplorable condition for the patients which is protracted for years.

Therefore, in lepra nervorum the essential feature is not the paralysis of motor nerve-fibres, but the atrophy of the contractile substance. Nor have we to record any disturbances of co-ordination, although the anæsthesia of the skin, going hand in hand with the motor weakness, now and then simulates morbid pictures resembling tabes. (Thus most of the patients cannot manipulate with the hand except by the aid of the sense of sight.) There is no vertigo when the eyes are closed.

C. Finally we have to treat of the complex of symptoms described as *lepra mutilans*. In later stages of the local processes, after anæsthesia, analgesia, and atrophy have been long established, there occur on the extensor surfaces of the joints shallow, slightly suppurating, indolent ulcerations. The disintegration extends into the depth, implicates the ends of the bones at the joints, and finally attacks the joint itself, and without any particular manifestations of reaction the part situated peripherally from the joint—phalanges, a whole finger, even an entire hand—is cast off. Indeed, in this way are produced the most remarkable deformities, especially of the hand. Or else the ulceration establishes itself on the sole of the foot, causes extensive penetrating destruction which leads to greater or less mutilation of the foot, and now and then gives rise to serious complications by the pyæmia, erysipelas, etc., starting from it.

In conclusion I repeat that to me it appears that in the production of mutilation the complete anæsthesia has more to do than a trophoneurosis, although the latter is not to be altogether excluded.

In thus closing the description of the symptomatology, we shall again point out that there is no regular succession of the several symptoms and symptom-groups, or at most it can be fixed only within the very widest limits. At first there is a predominance of the symptoms of irritation (painfulness, hyperæsthesia, bullous eruptions, abnormal pigmentations); later they are found only isolated on formerly unaffected regions; while the zones first attacked are subjects to anæsthesia, analgesia, loss of pigment, atrophy of the sweat-glands, of the adipose tissue, of the muscles, and finally to mutilating ulcerations.

In addition to this we have the fact that the process taking place in the nerve, the chronic perineuritis, attacks the primitive bundle irregularly, "and this explains how in the same nerve region some parts are insensible, others sensible, and how of nearly adjoining muscles one atrophies and the other is preserved." (Virchow.)

With this group of phenomena may be associated other symptoms not directly connected with the leprosy. The sexual function may become impaired. The bodily temperature falls, the patients have a permanent chilly sensation. The heart's action languishes.

The COURSE of lepra anæsthetica in general is slower than that of the tubercular variety, and it leads to death from exhaustion and marasmus.

The PROGNOSIS, therefore, as regards the duration of life, is somewhat better than in the tubercular form; but the fate of the patients is far more deplorable.

PATHOLOGICAL ANATOMY.—As is well known, Virchow was the first to call attention to the anatomical alterations in the nerves. We fully coincide with Virchow's view and place the primary pathological process in the peripheral and cutaneous nerves, in which a leprous new-formation leads to compression and atrophy of the sensory and trophic fibres. The patho-anatomical demonstration of this atrophy has recently been furnished especially by Leloir, who points out the existence of a parenchymatous neuritis by the side of the interstitial neuritis, leading to total atrophy of the nerve-fibres. According to him, this degeneration of the nerve-fibres depends not always directly on the interstitial process, but may also occur primarily.

While all authors admit the existence of these peripheral processes, there is still some uncertainty whether they are to be interpreted as the primary ones, or whether there is not rather a central affection, springing from the brain and cord. In fact, there are on record by various authors some positive post-mortem demonstrations of changes in the spinal cord. Opposed to these observations are a number of purely negative examinations, so that I am more inclined, owing to the constancy of the peripheral changes and the inconstancy (and in positive cases not specifically leprous character) of the central lesions, to regard the nervous form of leprosy as a disease of the peripheral nerves.

Most frequently affected are the ulnar, median, radial, musculo-cutaneous, intercosto-humeral, and peroneal nerves.

On the bones we find mainly necroses together with carious processes and interstitial absorption.

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Between the two, the cutaneous and the nervous forms of leprosy, is a whole series of mixed forms. Indeed, it may even be asserted that there is hardly any pure case of strictly cutaneous or purely nervous leprosy, although it is possible to separate the cases clinically according to the most prominent symptoms. As "mixed" forms, then, we shall have to record the cases lying about midway between the two. Observation teaches that a case may also change its position; for instance, being tubercular in the beginning of the affection, and later becoming "mixed" by complication with nervous symptoms.

This variety is also the more frequent one; namely, the mixed forms are usually at first tubercular with subsequent disease of the nerves, more rarely the "anæsthetic" forms become "tubercular" afterwards.

Leprosy prevailed already among the Jews and the Egyptians, as appears from Exodus. Hippocrates was acquainted with the disease, but only from descriptions.

In Greece it became more frequent in the last two centuries before Christ.

In Italy, in the second century of our era.

Thenceforth the spread was rapid over the greater part of Europe.

In France, we find leper houses in the seventh, in Germany in the eighth century; as early as 757, edicts against marriage were published.

The disease reached its greatest spread at the end of the eleventh century on account of the crusades. It is said that there were 2,000 leproseries in France and 19,000 throughout Europe. Founding of the order of St. Lazarus for the care of the leprous.

In the course of the sixteenth century, leprosy in Europe disappeared more and more, while at the same time syphilis spread epidemically.

Since then the geographical spread can be almost positively traced to the introduction of the disease from countries affected with leprosy.

## GENERAL PATHOLOGY.

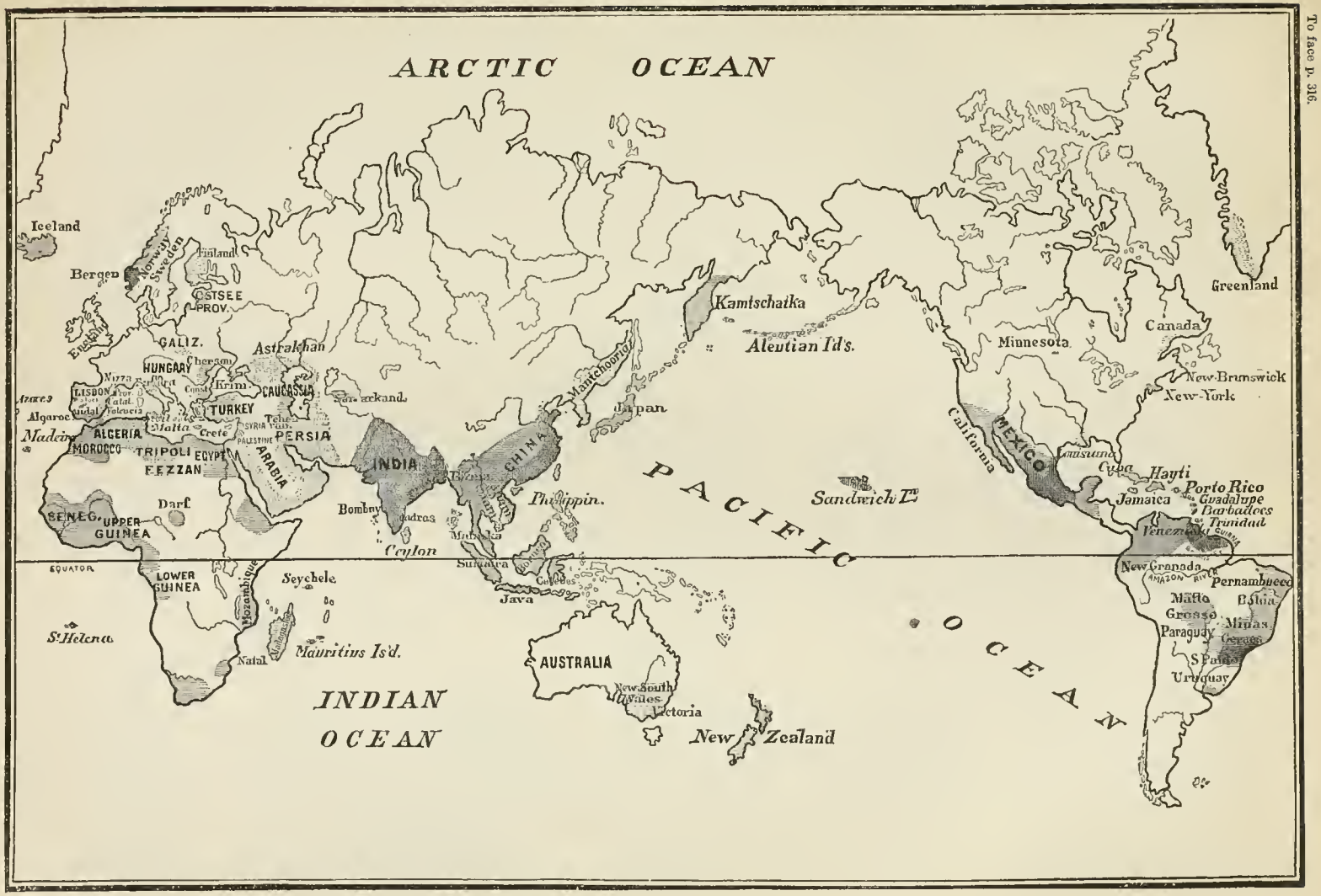
The new-formation characterizing leprosy is found most frequently and in its most extensive development on the external skin and the mucous membranes, in the shape of circumscribed nodes or in more diffuse infiltrations (both in the tubercular and in the macular form, which latter is considered a stage preliminary to the nodes).

Opposed to the tubercular form stands lepra nervorum, the so-called lepra anæsthetica, in which Virchow demonstrated the proliferation in the interstitial nervous connective tissue resembling that in the external cutaneous nodes. We are also familiar with new-formations in the substance of the cornea, and with such as penetrate into cartilage and are indicated in the interstitial tissue of the spleen, liver, etc. The lymphatic glands and the testicles are likewise very intensely attacked. (But I should not refer these alterations in the last-mentioned organs to interstitial proliferating processes.)

All these neoplasms show a corresponding structure; a cell-mass separated by sparse fibrillary intermediate tissue; the cellular elements, in their recent condition exactly like lymph-corpuscles, gradually increase in size, the body of the cell reaching four or five times its original volume, the nucleus likewise undergoing material increase, and now and then several nuclei are present in a single cell. The form of the cells in the great majority of cases is round; the spindle shape of the mostly large protoplasmic bodies is found more sparsely. The neoplasm, which is traversed by abundant blood-vessels, and in the neighborhood of which the cellular accumulation is most dense, is distinguished by great persistence, may remain for years, but finally disappears almost completely by gradual absorption, leaving deep-brown, pigmented, slightly thickened, otherwise little altered skin. Before the complete degeneration, we find on the large, pale, slightly granular cells forming the neoplasm in this stage a peculiar phenomenon: "a species of vacuoles is developed," bright, spherical lacunæ in the compact cell-mass.

In these lepra nodes, therefore, we have to deal with a tumor originally composed of ordinary granulation cells—a tumor the cells of which possess a remarkably long duration of life, in a certain sense present stages of further development: enlargement, formation of giant and spindle cells; finally, after a period of vacuole formation, disintegrate and vanish.

But at the place of the former tumor, a flat thickening and elevation of the skin or of the subcutaneous connective tissue remain behind. This thickening, *i. e.*, the deposition of masses of connective tissue, is very pronounced on the nerves, between the bundles of which we find, in the later stages of the process, numerous thick trabeculæ of fibrillary tissue. The circumference of the nerves at these points exceeds the normal considerably (spindle-shaped swelling), the quantity of the nerve-fibres, however, is remark-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New Granada
Pernambuco
Bolivia
Matto Grosso
Minas Geraes
Paraguay
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Madras
Ceylon
Sumatra
Java
Celebes
EQUATOR
SENEG.
UPPER GUINEA
LOWER GUINEA
Darf
Seychele
Mozambique
Natal
St Helena
Mauritius Isd.
AUSTRALIA
New South Wales
Victoria
New Zealand
INDIAN OCEAN

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ably diminished, so that from this alone it is possible to draw a conclusion as to the size of the connective-tissue new-formation. I do not believe, though, that this connective-tissue formation proceeds from the lepra cells themselves, but from the inflammation occurring around the neoplasm (which represents nothing but a foreign body).

There is a copious network of blood-vessels within the swelling; after they have perished, large concrements of blood-pigment are left in the remaining connective tissue. The ulceration occurring on nodular new-formations is always secondary and traceable to external factors, and does not belong to the history of the leprous node.

The peculiarity of the above described process, especially its chronicity, must naturally give rise to the inquiry after the cause of this specific behavior, and lead to the search for noxæ, of chronic type or capable of reproduction.

We personally decidedly assume that the cause of leprosy is to be sought in the existence of a specific bacterium, the bacillus lepræ. To be sure, thus far we lack the experimental demonstration that a formerly healthy man, living in a country free from leprosy, has become affected with the disease by inoculation with this bacillus, nor have the experiments absolutely succeeded in animals. Our reasons for this belief are the following:

I. The bacillus lepræ is a specific parasite, hitherto found in the human organism only in leprosy.

It is met with in all leprous processes, in nearly all organs, usually within the cells constituting the new-formation, more rarely free in the tissue; furthermore, in free hives in the purulent secretions of disintegrating nodes. Examined in the recent state or in unstained preparations of tissue (after hardening in alcohol), the bacilli are recognizable with difficulty; but easily after the staining of sections in any anilin color. The staining succeeds less readily with dry preparations. (The bacilli are best stained in solutions of pigment in anilin oil.)

After the staining, the covering-glass may be rinsed in acidulated water; they are then dried and mounted in Canada balsam. By this method, only the lepra bacilli remain well stained, other bacteria lose their color.

Very interesting is the finding of bacilli in dry leprous nodes of the skin and the mucous membrane merely inclosed in paper, as described by Köbner. In sections from tissue thus preserved, the bacilli are so conspicuous above the unstained fundamental substance that Köbner specially recommends this drying of the nodes as an excellent method for the study of the bacilli.

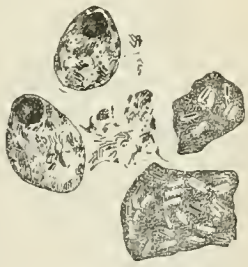

Fig. 23.—Lepra cells with bacilli and isolated bacilli with the formation of spores. The dark flakes are stained cells in which the envelope of the bacilli is visible in the shape of lacunæ.

The micro-organisms thus rendered visible are exceedingly fine thin rods; now and then tapering on both ends, of one-half to three-fourths the length of a red blood-corpuscle. Their breadth is one-fourth or less of their length.

Thus it will be seen the bacilli of leprosy bear a remarkable resemblance to those of tuberculosis. But they are distinguished from each other by their staining relations. The bacillus of tuberculosis can be stained only in alkaline solutions of pigment, while the bacteria of leprosy can be tinted easily also in neutral and acid solutions: gentiana, fuchsin. Only with anilin brown it has been impossible hitherto to color the bacilli of leprosy.

Instead of a slender entire bacillus, very frequently small granular particles are

found. These are either products of degeneration—and then the granules are irregularly scattered in the protoplasm of the cell, coarse and variable in size—or else the granulation is the sign of a progressive act, the formation of spores. The latter consists normally in the occurrence of oval, non-tingible formations, two or three in number, which break the continuity of the rod like lacunæ. (Under, as I believe, unfavorable or abnormal conditions of growth, it seems that also spherical swellings of these spores develop at the ends and in the course of the bacilli.) Characteristic, moreover, is the presence of a comparatively broad mucous envelope, easily rendered visible in dry preparations stained with watery anilin solution (fuchsin, gentiana violet, etc.). (Comp. *Virchow's Arch.*, p. 526, 527.)

Another mode of growth, which I have observed both in cultures (on blood-serum gelatin) and with lepra nodes introduced into the abdominal cavity, is the lengthening of the bacilli into threads, which are about four times the size of an ordinary rod. The formation of spores in these threads did not differ from that in the short rods. Cornil claims to have observed such threads also in organs, the anatomical structure of which, showing cavities and fissures, permitted this growth. (Cornil's results should not be interpreted as threads, but merely as closely aggregated single bacilli.)

II. The bacillus is constantly present in all forms and varieties of leprosy in all countries.

Apart from the investigations of Armauer Hansen, the real discoverer of a microorganism in lepra, there are on record descriptions of the bacillus lepræ by myself (material from Norway, Spain, Brazil, Roumania, Palestine, Hindostan, Dutch Guyana, Batavia); A. Hansen (Norway), Cornil (Spain), Hillairet, John Hillis (British Guyana), B. Hernando (Spain), Köbner (Brazil), Atkinson (North America), Majocchi and Pellizari.

Hansen examined the juice from freshly-excised cutaneous nodes. He found:

"Almost exclusively round cells, a few with fat-granules, many finely granular (called by him 'yellow and yellowish-brown elements'). Others contain small rod-shaped bodies which are partly limited by parallel lines, but in part taper at both ends, in which latter case their thickness in the middle is about twice that of the other bodies. Similar corpuscles are also found free where the pressure of the covering glass has formed small lakes, surrounded by dense accumulations of cells; in this lake of serum the corpuscles move in the manner of bacteria. Other preparations are produced in the following way: A drop of distilled water is placed on the slide and examined with a Hartnack's immersion No. 9 to see that it contains no formed elements, then the cut surface of the nodes is scraped with the knife as before, and the scrapings spread in the drop. In such preparations a much larger number of the small corpuscles appear, which here move also far more rapidly. The greater part of the cells swells considerably in the water, and in these swollen cells the rod-shaped bodies are far more easily observed; some appear as if garnished with them, at first sight it looks as if the cells were filled with coarse granules, but on accurate focussing it is seen that these apparent granules are small oblong rod-shaped particles."

The accuracy of these observations we shall acknowledge to-day without reserve. But the proof which was still lacking was furnished by me in September, 1879.

III. In every single case of leprosy, the bacillus is found in all more recent new-formations of the skin, the mucous membranes, the cornea, in the cartilage, in the interstitial nervous connective tissue; also in the connective tissue of the spleen and liver; finally, in the lymphatic glands, the testicles, and epididymis.

In these organs they are found in quantities corresponding to the degree of the affection.

With the onset of symptoms of absorption of the neoplasm, the bacilli also exhibit

corresponding signs of degeneration; disintegration into irregular granules; finally, total disappearance, when the new-formation has vanished.

A. The bacilli of the skin are present both in the nodules and in the more diffuse infiltrations.

The bacilli lie almost exclusively within the large round lepra cells described by Virchow, which, separated only by a fine connective-tissue framework, are closely packed. These cells, often exceeding the volume of a pus-corpuscle five times, contain one or several (three to twelve) large bright nuclei, greatly resembling those of the epithelial cells, and very frequently appear crowded unsymmetrically toward one wall of the cells.

The bacilli and their descendants either fill the entire protoplasm of the cells diffusely or, more frequently, there are several small circumscribed accumulations of from two to seven longitudinally apposed rods. Now and then two or three lie lengthwise one after another, presenting the appearance of a long, though not straight filament. Or else, the bacilli pushing in all directions over each other, form such a compact pile that its composition of foreign organisms can be recognized only on close inspection. Especially in those cells we encounter, beside the slender smooth bacilli, numerous shorter rods and finely granular particles.

FIG. 24.—Section from a lepra node. Power=Zeiss' oil immersion 1/12, with eye-piece No. 4.

The deepest cellular layer, *i. e.*, that in the subcutaneous connective and adipose tissues, contains, together with many unchanged lymph-cells, the most recent and smallest tumor cells with relatively few bacilli in the protoplasm. Gradually ascending, the cells enlarge.

The oldest layers touch a stratum of subepidermal connective tissue which separates from the infiltration of the corium, the epithelial layer running in a straight line and deprived of its descending rete cones, but otherwise normal and merely strongly pigmented.

Most numerous in this uppermost layer are peculiar large, round, sharply-limited accumulations which untinted present a strong waxy lustre, but in anilin colors take an almost homogeneous deep stain. The anilin preparations teach that these globi represent merely cells very densely infiltrated with bacilli (and their products), and caused to degenerate. These globi correspond to the "yellow flakes" described, many years ago, by Hansen in older leprous nodes of the skin, the spleen, and the testicles.

Besides the large lepra-cells, we see traversing the infiltration in longitudinal streaks small connective-tissue cells which here and there are infiltrated with bacilli and then form rather larger spindles than usual, and small cells differing in nothing from migratory cells; the latter free from bacilli. The presence of free bacilli between the cells in the connective-tissue trabeculæ is very limited.

However, I could never demonstrate bacilli with certainty in the blood-vessels. But the entire arrangement of the infiltration is governed by the framework of the ascending blood and lymph vessels. This connection of the vessels and the cell mass inclosing them cylindrically is especially clearly displayed by transverse oblique sections, while the smaller vessels, extending in the centre of the infiltration, remain without any special influence on the distribution. In the subcutaneous adipose tissue, the lobular arrangement prevails.

B. These descriptions referring to the skin so completely cover the conditions in the mucous affections of the mouth, palate, and larynx that their delineation would be nothing but a repetition.

C. Examination of the mucosa of the larynx also taught that both the epiglottideal and the thyroid cartilage had suffered an invasion of bacteria. Starting from the perichondrial connective tissue, the slightly-enlarged, spindle-shaped cells of which contained numerous bacilli, chains of round cells always infiltrated with bacilli could be followed in the reticular cartilage between the cartilage-cells. Free rods were also seen in the tissue of the reticular cartilage. At the thyroid cartilage, the perichondrium of which likewise contained bacilli, only free bacilli immigrated into the substance of the cartilage and finally were visible in the inner space of the capsule of the cartilage by the side of the nuclei. Even here the formation of small globi had been effected. In these preparations the intermuscular connective tissue of the larynx also contained bacilli and globi.

D. The appearances in the cartilage most closely resemble those of the cornea "which was made opaque by an immigration of lymph cells directed from the margin toward the centre. All these cells contained minute rods which were, however, also found isolated, penetrating between the lamellæ of the cornea."

E. The presence of bacilli in very large numbers in the testicle I was able to demonstrate in five subjects. I found the fungi within the canaliculi of the testicle and in the intertubular tissue. Once they were also in the epididymis. While in the cells of the canaliculi the several bacilli were still clearly visible, the lumina of the canals of the testicle were filled with a compact mass. In unstained sections they had a beautiful yellow, glossy, flaky appearance, as if composed of single amber beads; stained in anilin colors they took a uniform tint and it could be recognized that these flakes were nothing but dense accumulations of bacilli and their products of degeneration.

F. Cells containing bacilli were likewise found in the interacinous connective tissue of the liver in recent interstitial hepatitis. Cornil describes them also within the liver cells proper.

G. I have examined two specimens of the spleen and found isolated foci of bacilli in the shape of small heaps situated near the follicles, joined to large cells.

Of the kidney I have examined but a single specimen. It showed intense amyloid degeneration with interstitial nephritis. No bacilli or specific alterations could be detected. Köbner likewise could demonstrate no bacilli in the urine.

H. All the lymphatic glands examined showed very extensive infiltrations of bacilli in the peripheral zones, in which blood pigment, even macroscopically visible, was accumulated in quantities. The interfollicular tracts especially contained large multinuclear, polygonal cells with bacilli.

I. In a small portion of lung were found cheesy necrotic patches without the fine bacilli; but many long chains of bacteria immigrated, I believe, post mortem.

K. Of special importance, however, is the finding of bacilli in the peripheral nerves;

for thereby we trace with certainty to a single pathogenetic noxa the former clinical duality of the tubercular and anæsthetic symptoms. In most of the nerves formerly examined by me my endeavors to fill this gap were futile, because I always had under observation old terminal forms of disease. And that the bacilli finally perish we need not emphasize specially, after the experience gained on the skin. Just as, in my first communication, I had interpreted the "yellow masses" which I had seen in Christiania with Prof. H. Heiberg, as agglomerations of bacilli, so I was now in the fortunate position, by the death of a leprous patient from an intercurrent acute disease, to demonstrate on recently affected nerves the identity of the interstitial process of the peripheral nerves with the leprous new-formation in the skin, and show the presence of bacilli in the large cells between the nerve fibres and bundles. (Hansen raises the objection that these results would be valid only for the nerve alterations in the tubercular form. But it rests with him to prove the difference he supposes to exist.)

In the same way I hold that the theory advanced by Leloir and Hoggan, that lepra nervorum is a primary disease of the nerve-fibres and not an interstitial inflammation with subsequent secondary pressure atrophy of the nerves, lacks adequate support because those authors examined only nerves which had been long diseased. The fact which contradicts my view, that accumulations of bacilli are stated to be absent in such nerves, is devoid of force, because these conditions can be studied only on recently affected nerves.

L. The bacilli are absent, however, as far as investigations to date teach, in the spinal cord, in the muscles, and take no part in the production of the bullous (pemphigus) eruptions and in the affections of the bones and joints. Nor do we hold these processes to be primary, direct leprous affections, but derive them from the primary nerve lesion as secondary symptoms.

The bacilli are absent, besides, in all epithelial tissues of the skin (rete Malpighii, hairs, glands). Loss of hair and glandular atrophy are brought about in a purely mechanical way by the compression exercised by the leprous neoplasm. But even the covering layer of the rete Malpighii never contains bacilli; between the new-formation developing in the corium and in the connective tissue of the papillary body on the one hand, and the epidermal investiture on the other, there always remains the free subepidermal zone; and as the epithelial covering is inaccessible from within to any invasion of the bacilli, so it is from without.

IV. It is possible to demonstrate microscopically as well as experimentally that with the presence of the bacillus lepræ the typical course of development of a migratory cell into a connective-tissue cell suffers that alteration the result of which we briefly term "lepra cell" since the time of Virchow.

Strictly, this point is divisible into two subquestions: 1. Whence do the cells originate? Virchow had considered the fixed connective-tissue cells as the mother cells of the subsequent granulation tumor. As opposed to this view which can neither be proved nor disproved with certainty, we maintain that the granulation cells are emigrated white blood and lymph corpuscles.

2. How does a white blood-corpuscle develop into a lepra cell?

In reply to this question, I recapitulate the results of my investigations from my treatise above mentioned (*Virchow's Archiv*, Bd. 84, pp. 534 and 535) as follows:

A. Examination of the wound granulations springing up on the loss of substance caused by the excision of a broad cutaneous tubercle.

In a vertical section the lower layer appears very rich in cells in comparison with the upper. The latter is also free from blood-vessels, while they are quite numerous at the base and of great

volume which bears no relation to the thickness of the wall. The cells are deposited in an uncolored filamentous basis substance looking like coagulated fibrin, and generally are the size of a white blood-corpuscle, with a large dark-colored nucleus which nearly fills the cell. Now and then there are also several small nuclei instead. At the same time there are numerous epithelioid cells, especially in the neighborhood of the blood-vessels, of very variable form, and some young spindle-shaped connective-tissue cells.

In striking contrast to these small cells are others five or six times larger, with very voluminous, bright, vesicular nucleus, which contain masses of beautiful smooth bacilli (with and without spherical spores).

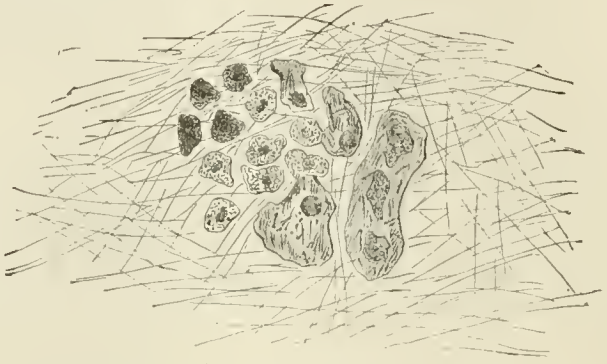

FIG. 25.—Section from wound granulations.

At times it seems as if these cells lie singly or together in lacunæ of the basis substance. Also giant-cells with three or four nuclei, with or without bacilli, are not rare. Besides the exceedingly well-preserved rods, we find smaller corpuscles tapering conically which are not bacilli viewed obliquely or vertically. I might add that these granulations proliferate with uncommon rapidity on leprous excision wounds. The formation of epidermis is long delayed through the crusting of the drying granulations.

B. Still more conclusive appear to me the experiments on animals. A freshly extirpated tubercle is under antiseptic precautions inserted into the peritoneal cavity of a rabbit (G. operated on November 6th, killed on November 11th). The autopsy shows the tubercle inclosed in a connective-tissue capsule adherent to the great omentum. Microscopic examination : The mass of the original tubercle has perished by necrosis ; not a single nucleus is stained. Only the arrangement of the clearly stained hives of bacilli still represents a picture of the tubercle cells formerly constituting the basis. Externally to this is first a zone so densely packed with granular detritus that bacilli are no longer recognizable. But the adjoining layer of connective tissue—in which we trace from the centre toward the periphery layers of all stages of inflammation and inflammatory connective-tissue formation to the development of ordinary narrow bright caudate connective-tissue cells—contains a considerable number of strikingly large, round, longitudinally oval and elongated bacilliferous cells with large bright nucleus, in form intermediate between epithelioid and completed connective-tissue cells.

Also in the newly formed fine-fibrillary connective tissue of the surrounding capsule we find bacilliferous cells in which the rods lie either in small agglomerations or scattered singly by the side of the nuclei. Everywhere the bacilliferous cells distinguish themselves by their size and by a retardation in development as compared with their neighbor cells of the like age in the same layer. The fact is noteworthy that the bacilli represented specially smooth and intact rods.

That white (inflammatory) blood-corpuscles generally can harbor bacilli may be demonstrated on every dry preparation of leprous nodular pus (after ulceration of such nodes). Cells in no way differing from ordinary pus-corpuscles are full of beautifully stained bacilli.

V. It may be demonstrated that corresponding to every developmental phase of the lepra cell there is a corresponding state of the bacilli.

The older and larger the cell, the greater become the number and density of the bacilli and their derivatives deposited in the protoplasm. Finally there arise large round, sharply limited agglomerations which untinted present a strong waxy lustre, but in anilin colors take an almost homogeneous deep stain. These agglomerations (globi) represent the acme of the bacillar infiltration in the protoplasm. At the same time, however, it is possible to demonstrate a change of protoplasm by chemical staining (by a distinct red coloration in gentiana violet instead of the normally obtainable decoloration of the body of the cell). Finally there is a direct connection between the vacuole formation and the condition of the bacilli, namely, the dropping out of the bacilli deposited in clusters in the protoplasm.

If we draw the conclusions from the facts thus far enumerated, we are justified, as far as I can see, in assuming :

The specific form and nature of the lepra cell is incited etiologically by the immigrated specific bacillus. This leads in natural sequence to the further conclusion : The entire affection is a bacterial disease.

And indeed, in our opinion, no doubt can exist about this point, even if the strictly scientific proof is still lacking for leprosy, as has been furnished for tuberculosis by Koch's cultivations.

That these cultivations are possible I have convinced myself by a number of successful trial cultures on boiled egg albumen and on blood-serum gelatin. It will be more difficult to find a species of animal appropriate for inoculation, nor is there on record a single positive observation of a (non-experimental) spontaneous leprous affection in animals. In two instances I succeeded in producing in dogs, by the introduction of small leprous particles into the subcutaneous connective tissue, local neoplasms identical with human lepra tubercles both histologically and by the presence of bacilli in the tumor cells. General disease did not follow these local processes.

VI. Leprosy is a contagious infectious disease. This is demonstrated, aside from the arguments thus far advanced, by the manner in which this plague formerly spread over the earth.

In the first place it is certain that lepra has been introduced into islands and countries formerly free from this disease.

We shall not dilate upon the more remote importations, and confine ourselves to two islands of which accurate data are on record.

On the island of Trinidad there were in :

| | | | | |
|---|---|---|---|---|
| 1805, | among | 29,940 | inhabitants, | 3 patients ; |
| 1813, | " | 32,000 | " | 73 " |
| 1878, | " | 120,000 | " | 860 " |

The most instructive example, however, is presented by the Sandwich Islands. On these islands, distinguished by the healthfulness of their climate, the excellent fertility of the soil, the fine and vigorous physical development of the natives, the disease had occurred until 1859 only in isolated cases carried thither by landing sailors ; among the natives it was altogether unknown. In 1859, a German physician, Dr. Hillebrand, observed the *first two cases of leprosy* on the islands themselves, on two immigrated Chinese who came under treatment at the Hospital in Honolulu. Since then the disease has increased rapidly to such an extent that as early as 1866 the government was forced to resort to measures of isolation, and forwarded four hundred patients to a smaller adjoining island (Molokai). In 1881, the number of patients in Molokai is *eight hundred ;* the last statistics of the Board of Health estimate that about 4,500 natives, that is, one-tenth of all the aborigines, are affected with leprosy.

The native population amounts to about 45,000. From the publications of this Board of Health we learn also that in the last fifteen years about 2,000 lepers have died at Molokai. All those familiar with these islands are agreed that the morals and character of the natives specially favor the spread of an infectious disease; while their physical development, and the excellence of the climate must appear absolutely inadequate to explain the etiology. Stress is laid on the dwelling of large families in small huts, the common use of the same vessels and utensils, eating from a single dish, the fingers being employed for taking out the eatables, drinking from one and the same vessel, smoking the same pipe, the very loose morals, the absence of any dread of the disease, whence patients are not only not isolated, but, on the contrary, secreted as much as possible by the authorities; hence also cohabitation and marriage between the well and the sick, etc. The natives, however, even hold the disease to be contagious.

Still not only natives suffer the disease, but often enough immigrated Europeans, in whom the disease can almost generally be traced to longer, more intimate intercourse with other lepers. That such an infection does not take place in every instance can be enumerated as a counter-argument in lepra as little as in similar cases of syphilis.

Genuine cases of leprosy, in countries free from the disease, however, do not exist. Such, at best sparse, reports date altogether from a time when the only pathognomonic sign—the demonstration of the bacillus—was not known. All cases of true leprosy occurring in Germany, England, France, etc., can without exception be traced either to infection from lepers or, more commonly, to residence in tropical leprous countries.

Like the appearance of leprosy, so its spread and disappearance can be traced only to contagiousness, not to miasmatic conditions. For we may formulate the law: The spread of leprosy stands in inverse relation to the measures of isolation to which the patients are subjected in the several localities. By the rigorous seclusion of lepers this plague was exterminated several centuries ago in Germany and France; and the same fact is repeated on isolated islands by appropriate measures taken by the government.

In Norway, too, the number of patients is steadily diminishing, since the majority of lepers have been more or less isolated in the hospitals erected.

However, it should be stated here that the relations of the disease prevailing at the present time in Norway, Spain, Livonia, etc.—for instance, the rarely demonstrable occurrence of direct infection (of the hospital attendants, from husband to wife, etc.)—cannot be utilized in the settlement of the present question without qualification.

In these countries we are undoubtedly dealing with a weaker quality of virus—a fact demonstrated by the average duration of the disease in Europe, 15 to 25 years, as compared with that on the Sandwich Islands, 3 to 5 years.

Thereby the factors above indicated, which are necessary for the actual effectuation of the infection, gain still greater importance. The more scrupulous the cleanliness, the more airy the living-rooms, the more the patients are isolated in the family, and the greater the fear of the disease, etc., the less the affection will be able to spread—relations which are present in an absolutely equal manner in syphilis and are universally recognized.

It remains for us to state that the inhabitants of the Sandwich Islands were seized in an equally terrible and rapid manner with syphilis, and for the same reasons, above given, which allowed so swift an extension of lepra.

The transfer takes place from man to man, and may be direct, or indirect when only the bacilli or their spores are transmitted. Pus containing bacilli (spores), therefore, will be liable to infect, but not any kind of pus coming from a leprous patient. Whether, in analogy with anthrax, the spores possess so great a power of resistance that they retain

their vitality outside of the animal body in the corpses of lepers, and thus are able to provoke the disease when they subsequently reach the human organism, has not been ascertained. This infection—by the spores of former human lepra bacteria—is by no means a purely miasmatic one; nor do I believe that, in order to produce the disease, formerly non-pathogenetic bacteria change into pathogenetic ones within the human body.

The way in which the infection is brought about is likewise still a matter of supposition, though well founded. At any rate, here as in tuberculosis, there is required a lesion of the external layers of epidermis which allows the penetration into the subcutaneous or submucous connective tissue. Inasmuch as the growth of the bacilli is very slow, a superficial excoriation, from which the bacilli can be easily removed, will not suffice, but there must be the establishment of a more deep-seated protected focus of infection. The bacilli enter the organism either as such or, more probably, as spores; remain in incubation, varying with circumstances, in depositories, perhaps the lymphatic glands, and thence migrate into the rest of the body. Judging from the participation of the lymphatic glands, in the majority of cases the first infection takes place on the skin of the face, the hands, the genitals, and on the mucous membrane of the first respiratory passages. At least great swelling of the glands in the inguinal or submaxillary region is a regularly recurring condition. (Recently, indeed, Koch has demonstrated in anthrax that the participation of the lymphatic glands furnishes no certain landmark respecting the point of infection in any infectious disease.)

The duration of the incubation in lepra is extremely variable. Its determination is all the more difficult because a true primary affection is altogether absent, and lepra really always presents itself to us as a complete constitutional disease. Men have contented themselves with reckoning from the approximate date of the infection—sojourn in a leprous country—and accordingly have assumed incubations extending over years, even decades.

The spread of the bacilli or their spores in the organism takes place chiefly, if not solely, by way of the lymph channels.

According to my investigations, the blood-vessels under ordinary conditions do not seem to transport either bacilli or spores. I did not succeed in a single instance in demonstrating bacilli in the lumen of blood-vessels, and I have always had negative results with dry preparations of blood. Also cultivations of blood taken from healthy portions of skin remained without positive results. On the other hand, if the blood be drawn from leprous new-formations, spores and bacilli, demonstrable microscopically or by cultivations, get into the escaping blood, through the mechanical lesion, from the neoplasm out of the lymph channels. The opposite view is entertained by Majocchi and Pellizari. Köbner, too, noted the isolated presence of bacilli in the blood, but agrees with me in this, that the lymphatic vascular system is the main channel for the spread of the bacilli. The latter are transported either in the free state or by white lymph-corpuscles.

In favor of this view are further:

1. The arrangement of the infiltrations around the adventitiæ of the blood-vessels which have been demonstrated to contain lymph spaces, while within the blood-vessels bacilli could not be shown with certainty.

2. The clinical observation that both the first outbreak and the relapses of tubercular eruptions on the skin appear with erysipelatous cutaneous inflammations known to us as diseases of the lymphatic vascular system. Suppuration never occurs with them,

from which we may deduce the peculiar character of this disease which is akin to erysipelas. These same forms of dermatitis, on the other hand, always lead to local recoveries on the affected regions—disappearance of the tubercles, leaving brown spots containing an abundance of amorphous blood pigment—but invariably give rise to an exacerbation of the entire course, with renewed leprous eruptions in other cutaneous regions, that is to say : plentiful transportation of fungi from one region into another.

It is likely that the blood vascular system participates in this transportation of spores in "erysipelas," but thus far this supposition remains unproved. Majocchi and Pellizari state that the presence of schizomycetes in the blood will manifest itself best in the eruptive period of leprosy, or, to speak more correctly, with every repetition of an eruption.

3. The above-mentioned experiments on animals (introduction of freshly extirpated tubercles into the body of rabbits and dogs) prove the fact that there are local transportations of bacilli and spores without the participation of blood-vessels.

Presumably only spores are carried from one region to another, while the local progress of the leprous infiltration probably takes place by the peripheral migration of bacilli (*e. g.*, in the cornea).

Finally, in favor of the view that the lymphatic vascular system transports the spores or bacilli, is the extraordinary swelling of the largely bacilliferous lymphatic glands and their great painfulness during all the erysipelatous affections accompanying the errruptions.

But is the contagion of leprosy transferable by way of intrauterine infection ; IS LEPROSY HEREDITARY OR NOT ?

Most authors incline to the view of hereditary, by the side of direct infection in extrauterine life. Others speak of inherited disposition. In our opinion, there is no satisfactory PROOF for either of these views ; but more for the former than for that which would only grant inherited disposition. On the other hand, we must admit the POSSIBILITY of heredity, and especially of an hereditary disposition.

The doctrine of heredity is based exclusively on statistical data. Against this it must be objected :

1. These tables do not give such high figures in favor of the asserted heredity as to appear demonstrative by reason of striking numbers.

2. But these tables and their results admit of another interpretation—infectiousness without heredity. In most of the countries in which leprosy still prevails, the patients live more or less isolated from the healthy population. The patients intermarry, the children grow up surrounded by their diseased parents, relatives, and neighbors.

3. The fact that the disease occurs very rarely previous to the third to fifth year of life, in most cases not before the second decennium, has more force against than for heredity. In all these cases we should have to assume an incubation lasting for years, even in regions in which the course of the disease itself is more rapid than this asserted latent stage. A case of congenital leprosy has never been recorded, as far as I know.

4. I hold it to be altogether erroneous to try to explain the spread of the disease by heredity only, without infection. We need but point to the rapid spread of the disease in the Sandwich Islands—from 2 to 4,500 in twenty-two years ; this would be absolutely inconceivable by heredity alone.

But, while the proof of a direct inheritance is still completely lacking, the assumption of an inherited disposition can be more easily defended.

For the two forms of leprosy, viz., lepra tuberculosa and lepra nervorum, are fre-

quently sharply demarcated geographically, so that in certain sections the one or the other form occurs almost exclusively. Besides, the cases in which hereditary transmission can be assumed are considerably more numerous in lepra nervorum than in tubercular leprosy. In explanation of this fact, I think, we might assume a congenital disposition, either of the cutaneous tissues or especially of the nervous connective tissue, which brings about the affection of these organs particularly.

As to the sex of the patients, we find a preponderance of males in all districts and in every form of leprosy.

Cases between the first and the tenth year are very rare, more frequent are attacks in the second, and most numerous in the third decennium, after which they decrease.

Diagnosis.—The diagnosis presents no difficulty in the tubercular form. But it is the demonstration of bacilli which facilitates the diagnosis of tubercular leprosy in the same way as it places each individual case beyond doubt.

More difficult is the diagnosis of pure lepra anæsthetica, especially in the initial stages. An accurate knowledge of the symptomatology is all the more requisite for these cases because the criterion valid for the tubercular form, the presence of bacilli, cannot be utilized during life, of course, owing to the localization of the leprous process in the peripheral nerves.

Once for all it must be borne in mind that there is no genuine leprosy in countries otherwise free from the disease, that the possibility of infection, by residence in leprous regions or by intercourse with lepers, must always be present.

Treatment.—Leprosy is an absolutely incurable disease. Although from year to year new therapeutic propositions are made which have proved effective in isolated cases, none of them have proved available for the extirpation of the malady.

All the more weight will have to be laid on prophylactic measures:

1. Isolation of the patients in hospitals; quarantine regulations against the introduction of the disease.

2. Prevention of the possibility of infection given by every single patient for his surroundings.

I refer in the first place to the careful, disinfecting local treatment of open ulcerations, the secretion of which contains bacilli and spores in specially large quantities. In the second place, the attempt will have to be made to remove the tubercular eruptions previous to their softening, which can be done, for instance, by chrysarobin. At any rate it seems to me as if the local treatment in general had not hitherto received the attention it deserves.

I shall merely mention the reported successful (?) attempt at securing improvement in lepra anæsthetica by nerve stretching, and even by suturing the nerve.

Change of residence to a non-leprous country or otherwise healthy climate has proved effectual. The course of the disease thereby usually becomes milder and slower.

This experience refers mostly to Europeans who return to their native country after they have acquired the disease in tropical zones. In these cases, the improvement should be ascribed to the fact that the patient is again surrounded by the accustomed and more appropriate climatic and other conditions. The little patient whom I have had under observation for two years (born in Surinam; sick from his fifth year; in Germany two years) shows no improvement in his condition, in spite of favorable surroundings and extensive therapeutic experiments.

## III. SYPHILIS.

Syphilis has hitherto been held to be the infectious disease most nearly related to leprosy. But now it is certainly determined that there is no connection in any direction between leprosy and syphilis, since a leper may also acquire syphilis. On the other hand, we know now that tuberculosis and leprosy represent a group of diseases belonging together through their striking resemblance, while syphilis is farther removed from them. Nevertheless the near kinship of these three affections to one another is not to be disputed, so that we feel justified in looking upon the contagion of syphilis as an organized, bacterial one. This reasoning from analogy becomes all the more important because the positive demonstration of the "bacteria of syphilis" seems to be still lacking. But recently Birch-Hirschfeld has published investigations to which I refer more in detail on account of their remarkable character:

On examining gummous tumors, he constantly found micro-organisms. The majority of the gummous patches were of relatively recent date. The bacteria were most numerous at the border of the granulation tissue as compared with the more centrally located cheesy infiltrations. They could be best demonstrated where the spindle-shaped and round cells of the granulation tissue were less dense. As a rule, they were altogether absent in the firmly fibrous parts of syphilomata, as well as in fully cicatrized gummous patches.

Wherever the bacteria are free in the tissue, they are always aggregated into small colonies. Then reference must be made to the presence of intercellular bacteria which could likewise be demonstrated in gummous tumors. The cells inclosing bacteria were roundish, oval, and also spindle-shaped elements of the granulation tissue; they were often spread over larger regions of the section, but the number of similar cells without bacteria in the neoplasm was by far the larger. The short, thick formations within the cells, exactly resembling those of the smaller colonies, partly filled them completely, partly they were distributed circularly in the periphery of the cell.

The micro-organisms thus described, however, are not to be interpreted as rods or bacilli, but they are cocci united into chains, thus simulating rod-like formations. The segmentation, it is true, is much more indistinct than in the majority of micrococci joined into chains; besides, the cocci, as a rule, are not round, but longitudinally oval. Usually we see micrococci and diplococci, more rarely three to five individuals united into one.

The demonstration of the above-described free colonies of bacteria is very simple. The sections (hardened in absolute alcohol and cut with the Rivet-Leister microtome) are placed for a short time in glacial acetic acid, then examined in glycerin. The colonies of bacteria can now be readily seen; they differ from the faded and swollen elements of the tissues by a certain lustre. The best staining agent is fuchsin in moderately concentrated aqueous solution. With this, the bacteria of the colonies, but especially the intercellular rods, exhibited a very beautiful red color which is again destroyed by concentrated acetic acid. Still better is a simple clarifying of the sections in caustic potassa, after which the cocci become visible in the tissue as strongly refractive corpuscles.

In the above-described manner examinations were made of gummous tumors, hardened in absolute alcohol (of the brain, of the lung of an adult and a new-born child, of the liver, of the supra-renal bodies, of the wall of the stomach, and of the intestine). In all cases the result was positive, although the quantity of the bacteria varied considerably, and in several objects only the smallest rows of cocci were found.

For the sake of comparison, portions derived from the living were examined in the fresh state; they were excised portions of broad condylomata, of an indurated chancre, of an excised papule of a papular syphilide. Here likewise were found the above-described colonies of small, relatively strongly refractive diplococci; most numerously in a broad condyloma, where they lay chiefly in the cells of the rete Malpighii and in the connective tissue of the papillary body. It is also feasible to demonstrate the micro-organisms by incising a fresh, non-ulcerated broad condyloma from its basal surface, scraping the juice from the cut surface, drying it on the covering glass, and staining it, best with fuchsin and gentian violet.

The blood of a patient suffering for a few days from roseola syphilitica showed no bacteria.

The demonstration of the same bacteria within gummous patches of different organs renders it very probable that these micro-organisms are indeed the carriers of the syphilitic contagion.

Whether these results will be confirmed or not, we believe it to be perfectly justifiable to interpret *syphilis as a bacterial disease* and shall attempt to explain the relations of the morbid process, of the infection, of the heredity, etc., from this standpoint. Of course, in entering on the details of the pathological process, we miss at every step the possibility of demonstrating the bacteria; in discussing such questions minutely, we are almost entirely confined to reasoning from analogy.

In still another, very important question, the demonstration of specific micro-organisms would bring the definite, longed-for decision: I mean the question of unity and duality of the venereal chancre poison.

I shall merely give expression to my conviction that the dual theory appears to me by far more firmly established; that therefore the syphilitic virus is altogether different from all those noxæ which produce the forms generally termed "soft chancres." Even if solitary cases appear ever so obscure in regard to the relation between the source and the product of infection, even if they *seem* to prove the unity of syphilis and soft chancre, it will have to be admitted that, with such involved factors and strange complications as are brought about by prostitution and extra-marital intercourse of the sexes, no basis can be gained for a positive theory from such incalculable observations.

To me the fact appears decisive that all cases of syphilis coming under observation are derived from syphilitic individuals, and not in a single case from a soft chancre without syphilis.

The acceptation of the mixed chancre which has been so freely assailed, moreover, corresponds altogether with the universally recognized observation that vaccine plus syphilis virus can be transmitted simultaneously and produce their respective effects one after the other, first small-pox pustules, then syphilis. It would even be remarkable if fewer cases of mixed infection were to occur than is actually the case. For the sources of infection are "mixed," that is to say, the preponderating majority are prostitutes who, besides the syphilis of long standing, harbor other ulcerations, vulgo "soft chancres." These latter are transmitted either alone or combined with syphilis, as the one or both of the poisons penetrate through the point of infection. Syphilitic virus, *i. e.*, parts of syphilitic neoplasms or blood (?), must be mixed with the infecting secretion if syphilis is to be transmitted. Inversely, if a man has exposed himself to the danger of infection and has not acquired syphilis, we can only conclude that no syphilitic particle has gained entrance into his system.

We must not identify syphilitic secretion with purulent secretion on a syphilitic person. Accordingly, no value can be ascribed to experimental inoculations with secretions derived from syphilitic persons, but the nature of which is not determined, whether it contains syphilis or not.

As regards the experiments on animals, it has been ascertained that monkeys, cats, and others were specially susceptible to soft chancres, while the attempts to inoculate animals with syphilis have given no positive results.

The transmissions to monkeys have, in another quarter, been referred to tuberculosis in their results, and can therefore as yet claim no full validity, for there is no proof that the neoplasms artificially produced were really of a syphilitic nature.

Moreover, there is on record a preliminary communication on inoculation syphilis of the iris and cornea of the rabbit, by Dr. Paul Haensell. Syphilitic particles were introduced into the anterior chamber; the thin-fluid purulent contents of an intact gum-

mons node, portions of mucous patches, pieces of a sclerosis before it had ulcerated. After a period of incubation of about one month, there were developed an iritis having a subacute character; then, several days later, those strongly vascularized nodules which in man are generally termed gummous tumors of the iris. In an animal which died in the sixth month after inoculation, with considerable emaciation, it was found that the lungs and liver were interspersed with small, rather hard nodules, which proved to be composed of round cells and larger, multinuclear epithelioid, at times also giant-cells.

A rabbit which had been inoculated with the products of this inoculation syphilis into the anterior chamber, presented the like appearances.

Compared with inoculated tuberculosis, the time of incubation here is much longer, and the whole course bears a much more chronic character. Of the greatest importance, however, are especially two differences. First, the nodules of inoculated syphilis are throughout their whole extent traversed by minute vessels which are altogether absent in inoculated tubercles; second, they never fall a prey to cheesy metamorphosis, which is always the case with the latter.

An attempted transmission to the monkey, which Martineau claims to have been successful, is still under observation. J. Neumann recently declared himself in favor of the doctrine of non-transmissibility to animals. He did not succeed in establishing the syphilitic poison in horses, rabbits, martens, rats, cats, or pigs; at most, there appeared local symptoms of reaction in consequence of the inoculation.

It may here quite briefly be stated that for the decision of the question above discussed, as to the unity and duality of the virus, the form of the primary ulcer ("soft" or "hard" chancre) is comparatively immaterial. We shall again revert to this point.

Nevertheless, fully conscious of the difficulties arising from this lack of sufficient and especially objective demonstrative material, I have thought it incumbent on myself to approach these questions. It appeared to me more valuable that a consistent interpretation of the pathology of syphilis be carried out from a single standpoint, even if at present still hypothetical.

In the first place, in regard to the relations of the modus of infection, we must bear in mind that the bacteria have to penetrate directly into the plasmatic channels of the organism. In the case of the external skin and the superficial mucous membranes (of the oral cavity, on the genitals), there are required, generally, mechanical injuries which arise at the moment of infection or existed previously. According to experience to date, an infection through the intact epidermis is not possible. It seems also that the mouths of the hair follicles and glands in their normal condition do not serve as points of entry to the virus. But whenever the virus meets open permeable fissures in the tissue, even if it be the most minute erosion, it adheres, and penetrates into the organism. Hence it does not require—as the bacilli of tuberculosis do—a specially protected locality; but on the contrary, in spite of the most rapid and careful efforts, it can no longer be removed from the supposed points of infection. This mode of infection by direct contact holds good for all syphilitic diseases acquired in extra-uterine life.

Non-effectuation of the infection (through a firm epidermis, etc.) must, of course, not be identified with immunity against the virus. As far as we know, this immunity does not exist in any man. (Whether the assertion that syphilis does not occur in Iceland, in spite of the plentiful nautical intercourse, corresponds to the actual conditions, and whereon they are based in that case, is to be ascertained by further investigations. Otherwise the spread of syphilis has kept equal pace with the advance of infected nations.)

Another mode of infection consists in direct introduction of the virus into the blood, such as takes place in intra-uterine syphilitic infections by means of the placental circulation.

Finally, the most direct and highest imaginable degree of infection is represented by the genuine hereditary transmission by the semen or the maternal ovum, for here all the formative material of which the new body is composed, harbors the infectious matter and develops under its injuries influence. But syphilitic semen or ovum is not to be identified with the semen or ovum of a syphilitic person. In the former case the virus is transmitted with it and will produce its specific effects, in the other case there is merely a certain cachexia of the parents, which (not being of a specific nature) will manifest itself perhaps in some constitutional anomaly (of a non-specific nature), for instance, rickets, etc.

In the two last-described modes of intra-uterine infection (*i. e.*, the "hereditary" and the syphilis acquired in utero), of course, there are no local primary places of infection.

As opposed to these forms, syphilis acquired in extra-uterine life begins always locally, *i. e.*, from a local point of infection. But this point of infection, in its appearance and the form in which it becomes manifest, is subject to the greatest variations which depend chiefly upon the anatomical configuration of the point of entry. On the skin there arise usually those neoplasms (syphilomata) which are termed "hard chancres," primary "indurations." On the mucous membranes, however, "hard chancres" are almost never seen to develop; there is a formation of superficial, corroding, non-indurated ulcerations or erosions, without any specific new-formation at their seat. (However, I wish to explain particularly that in my estimation these soft primary affections stand in no relation to the soft contagious chancre which owes its origin to a specific virus totally different, I am sure, from that of syphilis.) Only at the vaginal portion of the uterus indurated primary affections—dependent on the anatomical structure of the submucous tissue—develop frequently. Of course, with such insignificant primary affections, it may happen that they run their course unnoticed. In reference to these cases, which chiefly affect women, more rarely men, and in whom the infection naturally occurs on mucous membranes (because it is on the genitals) a syphilis *d'emblée* has been spoken of. If this is to mean: syphilis without a primary affection on the skin and mucous membrane discoverable by our eyes and fingers, this doctrine may be accepted. But if it is to signify that in these cases there is absolutely no local focus of infection present, we must object; for indeed it exists; although not visible to us on the skin or mucous membrane, it is in the lymphatic glands belonging to the point of infection (cutaneous or mucous).

The first discoverable sign of the disease (the primary effect, if you choose), then, lies in these very lymphatic glands in which the multiplication of the penetrated bacteria or their germs is effected.

Only subsequently, after a variable period of incubation, the general infection is brought about from these depositories, still representing local foci, as it were from within outward. Either the lymph channels serve this end—the ordinary course of the spreading syphilitic virus (also in leprosy, in certain cases of acute miliary tuberculosis)—or the infection of the blood produces the general disease (as in most of the acute miliary tuberculoses) (Weigert).

In syphilis, therefore, we have to deal (in the form acquired in extra-uterine life) with a local infection, mostly with a so-called primary affection at the point of infection.

But what significance has this local disease in reference to the general infection? Is it the focus in which the bacteria multiply during the period of incubation, and from

which the general saturation of the whole body takes place? Or have we to deal with an instantaneous general intoxication; a "primary" alteration at the point of infection developing only partly on account of the larger quantity of the infectious material acting at this point, partly on account of the local processes preceding or accompanying the penetration of the virus?

Unfortunately, it has been impossible hitherto to gain perfect clearness in this question. In the last few years it has been attempted to satisfy even this scientific want, with the therapeutic indications, by the excision of the syphilitic primary affections. However, the results are so variable that no definite conclusion can be reached. Where, after operative removal of an ulcer or node appearing after suspected coition, no general disease followed, it must be proved that the structure removed was actually of a syphilitic nature. I am of opinion that this proof cannot be brought with certainty for the early stages of a syphilitic primary affection, because the microscopic appearances which are looked upon as characteristic by Auspitz, Unna, and Cornil do not seem to me to possess the value claimed for them. Where the excision was still followed by general syphilis, it could be objected that the operation was done too late.

According to our view, this question cannot be decided positively. As in other infectious diseases, the space of time within which the general infection is brought about will vary with the manner in which the virus penetrates into the body.

If it enters at once into the circulation, an instantaneous general intoxication will result sooner than when the bacteria, multiplying in the lymph spaces of the infected district, reach the blood at a later date. If intense inflammatory processes accompany the development of the initial affection, the penetration of the syphilitic germs into the deeper tissues and thus into the general organism, is influenced by the inflammation (it seems to me injuriously). Clinical observation (in experimental inoculations and in accurately known infections) has actually taught that the lapse of time between local infection and general disease varies between wide limits. At all events, there is a lack of any constant relation between the intensity, course, etc., of the primary affection on the one hand, and the progress of the virus in the organism on the other hand. The chief importance attaches in every case to the quantity of the virus introduced.

We know quite analogous facts in other infectious diseases. I call to mind the experiments of Renault (d'Alfort) upon the absorption of the glanders poison, and those of Colin upon anthrax. In these experiments the absorption of the virulent substances was effected within a few minutes. Opposed to this fact we have the results of Davaine, who brought anthrax matters to the surface of wounds which had been caused in rabbits by means of vesicants, energetic friction, or excisions of portions of the skin. Some of the animals were saved from general infection when cauterization was performed with caustic potassa one, two, or even three hours after. Davaine gives the following explanation of the fact. "In a subepidermal inoculation, a small number of vessels is opened, which are in immediate collateral communication with others in which the circulation continues undisturbed. Therefore, the poison is at once introduced into the general circulation. In an extensive wound, however, most of the vascular trunks are severed and without any communication with the general circulation."

It appears to us that in syphilis the greatest stress is to be laid on the fact that the general infection proceeds gradually, and that we cannot say at a given moment that it is now present, while only a little while before nothing but a local trouble existed. I believe, therefore, that hand in hand with the development of the local primary affection and the great multiplication of bacteria taking place in it, the general disease is effected from that point. The formation of an induration ("hard chancre") has nothing to do with the process of infection. The induration is nothing but a peculiar reac-

tion of the healthy skin on the effect of the syphilitic virus. With or without induration, the primary affection is a focus of infection for the general organism. The sooner it is removed, the smaller will be the quantity of the virus penetrating into the body, and the greater will be the probability that no general infection will take place, for the latter presupposes a certain large quantity of infectious material. It can hardly be doubted that this multiplication may also occur subsequently in the organism, but it requires certain preliminary conditions—resting quietly in depositories—which do not exist from the start and do not form until after the more abundant presence of the bacteria in the tissues (local foci of inflammation).

Moreover, in this question a fundamental error is committed in considering only the hard chancre as the primary affection. The lymphatic glands appertaining to the initial affection have the same importance. Two facts are in favor of this view:

1. The concurrence in time, or separation by but a few days, of the disease of the glands with the induration at the point of infection.

2. The anatomical structure of these lymphatic glands. Several times I have had the opportunity of extirpating and examining them in very early stages of the disease. The appearance is essentially the same as in the indurated ulcer, *i. e.*, inflammatory hypertrophy and new-formation in the connective-tissue portion of the glands. But if the glands in the same stage are equally diseased as the initial affection of the skin, they must also have become diseased at the same moment; that is to say, we are forced to the assumption that at the moment of infection some germs penetrated also into the open fissures of the tissues, and migrating onward, reached the glands. This consumes several days—an interval which repeats itself with the disease of the glands. (It would even be by no means surprising if the bacteria of syphilis were to get into the circulation at once; the general infection, therefore, immediately following the local infection.)

The positive demonstration of the correctness of the above-defended view has been recently brought by Bumm (l. c., 11, p. 285), by an experimental inoculation.

He extirpated from a patient, in whom the syphilitic nature of a sclerosis had been assured by a macular eruption, two lymphatic glands which had swelled in direct connection with the primary affection (in the fourth week after the infection); they were scrupulously cleansed of all foreign tissue, split longitudinally with a scalpel, and with the milky-looking lymphatic serum which presented, the following inoculation was made on a non-syphilitic person: two punctures, on each arm, at a distance of twenty centimetres from each other.

On the seventh day after the inoculatiou, all the points of puncture, excepting one on the right upper arm of which nothing was to be seen and which subsequently also remained sterile, were marked by red dots the size of a pin point and barely recognizable. These points developed within five more days into slightly raised spots the size of a pin's head, and increasing rapidly, reached by the eighteenth day after the inoculatiou about the size of a cent. The surface was formed by a brownish crust, after the removal of which a small shallow ulcer remained behind. No further enlargement of the ulcers took place, but after ten more days an infiltration of the base occurred and a slight elevation of the margin which was surrounded by a red areola. At the same time it was possible to demonstrate some swollen and sensitive glandular bodies in both axillæ.

One peripheral point of inoculation of the left arm showed a very retarded course, and did not reach the phase of the other ulcers until a week later.

By the forty-third day after the inoculation, the sclerosis of both the base and the margins had developed more distinctly and the red areola around them had considerably increased. Its peripheral limitation was serrated in many ways and surrounded by a series of small papules. By the fifty-second day the outbreak of a maculo-papulous syphilide followed, with slight symptoms of fever. The macules appeared specially crowded together around the point of inoculation, where they partly changed into desquamating papules. A few days later, a multiple swelling was per-

ceptible in all palpable groups of glands on the upper half of the body, which could by no means be felt on the lower half of the body, especially not in the inguinal region.

This last observation teaches in an incontrovertible manner that the primary lymphatic glands are a focus of the virus equivalent to the hard chancre, and renders clear why the extirpation of the latter alone so rarely secured a radical result. As early as 1871, P. Vogt had therefore made the proposition, and Hardaway in 1877 had repeated it, to remove the glands together with the sclerosis. Although the results were not very brilliant, still the proposed method is to be adhered to. His cases came under treatment in a rather advanced stage of the disease in which the virus probably had already extended beyond the limits of the glands.

The removal of the glands was performed before that of the chancre and in every case was a very simple affair; the indurated glands can be enucleated together with their capsule with great facility from the surrounding loose connective tissue without any considerable hemorrhage occurring. A thin drainage tube was inserted into the remaining cavity, often pretty large, and the wound closed over it with deep sutures. Under an antiseptic pressure bandage the cavities closed by first intention in the majority of cases.

Finally it must be taken into consideration that we can hardly determine clinically when general infection has been effected in syphilis. Usually the view prevails that the time of general infection is to be identified with the appearance of visible symptoms (exanthem, polyadenitis). That this doctrine, in its general application at least, is erroneous is proved by a communication published by Finger, in which, in a patient recently infected, syphilitic efflorescences appeared on a previously irritated part of the skin two weeks before the macular general eruption developing subsequently in a typical manner, hence in that early period of syphilis which is usually designated as the second period of incubation.

If we adhere to the above developed view of the gradual poisoning of the organism from the focus of infection, we shall not be surprised on the one hand by the contradictory results of excision, on the other hand excision will still appear to us a very useful operation weakening the general infection. Wherever it is at all possible, the excision of the chancre will have to be combined with the extirpation of the glands.

As regards the general infection, this is effected, as above mentioned, most probably by way of the lymph channels: this explains those diseases of the lymphatic glands of the body which may be controlled step by step and followed anatomically, while the morbid foci occurring simultaneously in the skin will have to be traced to the participation of the blood channels.

But no matter in what way and at what time the spread of the infectious substances takes place, finally local pathological processes are produced at those points, and there only where the bacteria settle and find rest so as to unfold their activity.

In fact we see that from this period on (after the so-called second incubation) there are developed in all organs of the body in more or less regular order, pathological processes which provoke the most manifold symptoms. But another question presses into the foreground: To what factors can we trace the fact that these products developing in the course of syphilis, the etiological unity of which is certain, and which in their initial stages represent almost identical formations (heaps of granulation cells) give rise to such differences in their further course that finally that well-known polymorphism is effected which is characteristic of syphilis and which is capable of simulating all possible forms of efflorescences?

This question has been often raised and has found its expression in the many attempts at dividing the course of syphilis into several periods according to the varying morbid processes. Especially two great groups have been always placed opposite to one another.

From the anatomical standpoint the papular were separated from the gummous products (Zeissl, the condylomatous from the gummous stage). Virchow divided irritative inflammatory or hyperplastic processes from the gummous. According to the time of their appearance, they are separated into symptoms of the early and those of the late period, or according to the ordinary mode of expression originated by Ricord, secondary and tertiary symptoms. This difference in time corresponds with a clinical one: The early symptoms as a rule have a tendency to spontaneous absorption, are "benign," while in the late period the tendency to disintegration prevails.

But here a remarkable phenomenon must be taken into account, namely the different systems of tissue have a certain independence in reference to the time, and accordingly to the manner of their affection, so that every group of tissues must be considered specially by itself. For instance, for the syphilides of the skin and mucous membranes we reckon the division as to time from the day of infection; however, another measure must be applied to the syphilitic diseases of the periosteum and vessels, to the syphilis of intestinal organs. Thus the endarteritis syphilitica described by Heubner, which belongs almost invariably to the late period of syphilis, is to be counted, both anatomically and clinically *per se* (aside from the secondary alterations in the brain), altogether among the benign new-formations corresponding to the early syptoms of the skin. On the other hand, we know in every tissue, in every organ, those two forms of disease which we have above opposed to one another as "benign" and "malignant" (by the side of the ordinary endarteritis also the gummous form), corresponding to an earlier and a later implication of the system. But in that case "early" and "late" mean something altogether different from what they do in cutaneous syphilis, with which we are most familiar. Hence, to speak of a secondary and tertiary "period" is correct only with these limitations. Furthermore, it must be taken into consideration, especially for the diseases of the bones, that osseous new-formations of a permanent nature frequently occur in them; hence that the date, often late, at which such tophi, periostoses, are still demonstrable, is not to be confounded with the far earlier time of their origin.

The mere number of the attempted divisions must lead to the supposition that a strict (schematic) subdivision is really impracticable. Indeed, mixed exanthemata of anatomically the most divergent forms are not at all rare, and especially observations of simultaneously developing "secondary" and "tertiary" efflorescences are so frequent that the question appears justifiable: Is there actually any such strict separation between the several forms of syphilis as authors have made? Is there really an essential difference between the papulous and the gummous neoplasms, and can an explanation be found for the variation of the two forms?

Bäumler (p. 37) assumes for this purpose a changed quality of the tissues in the gummous stage. "At first the syphilitic virus itself is the cause of the neoplasms in the normally reacting tissues; however, in the development of gummata, we have to deal, probably, no longer with the effect of the specific virus on a normal tissue, but with the specifically altered reaction to any irritation of tissues modified by the preceding blood-poisoning." This view indeed has something very taking in it. There is nothing to prevent our assuming a modification of the tissues, even if we do not as yet know positively wherein it consists; we find like conditions (acquired immunity) existing unquestionably in other infectious diseases (in vaccinia, etc.); even in syphilis we are acquainted with such a modification in the fact that the induration of the primary affection can develop only in persons free from syphilis, but cannot be produced in an individual

affected with syphilis. Inexplicable though this "modification" of the tissues be in this observation, it is confirmed by a thousandfold experience.

To explain how this "modification of tissue" is effected and what is its nature, we might perhaps suppose a chemical incidental effect of the bacteria, of the kind with which we are well acquainted in fermentation, decomposition, the growth of aspergillus, etc.

Bumm makes the following remarks in reference hereto: If we have the opportunity of making an early auto-inoculation from an indurated chancre to its bearer, and especially if we choose for this purpose a spot as far as possible removed from the primary focus of infection, we can often make very instructive observations about the relations above mentioned. The following extract from the history of a case may serve in illustration.

K. C., æt. 25. Infection took place on August 5th, 1881. A couple of weeks later, moist spots were perceived on the prepuce which gradually changed into ulcers.

On August 22d, one larger and two smaller indurated ulcers were noticed, and with the secretion present, of which there was a sufficient quantity, an inoculation was made on the right upper arm. After three days the small crust of blood had become detached and the skin at the point of inoculation appeared perfectly intact.

On the tenth day after the inoculation, a red spot the size of a pin's head was first noticed at that point which slowly increased during the following days. At the same time swelling of the inguinal glands occurred.

On the twentieth day, a papule somewhat larger than a lentil, with slightly scaly surface, was found; it had a distinctly infiltrated feel. The next few days the papule underwent a grayish-yellow discoloration, and thenceforward retrogressed so that by the thirtieth day after the inoculation (the forty-seventh after infection) the entire formation had disappeared. Simultaneously with the retrogression of the inoculation papule, swelling of the cervical glands and an angina occurred. As the ulcers on the penis had healed in the mean time, the patient left the clinic, but soon returned with secondary symptoms.

In this case the inoculation at first progressed as in a healthy person: a quite characteristic papule developed which was about forming an ulcer by its disintegration, when suddenly the whole process, at the very time when the general infection commenced, came to a standstill. Such processes we can explain only by supposing that the organism at the time of the inoculation and for three weeks thereafter was not yet infected, and t ha therefore an inoculation papule could develop which of course made no further progress with the constitutional disease then ensuing, owing to the immunity conferred by it.

I might here briefly remark that perhaps it is incorrect to say: a syphilitic person possesses an immunity against fresh infection during the time the disease exists. For the time being, it is true only that during this time no typical primary affection is formed; but whether there is not a new invasion of virus with additional infection is an open question which can by no means be negatived without further investigations. Practically this relation is important only in so far as physicians and patients believe in immunity after infection without any qualification, and as the latter imprudently expose themselves to fresh invasions of virus.

Of Bäumler's view, therefore, we accept as proven only one part: the modification effected in the tissues of the body by the poisoning of the organism with syphilitic v rus. It is more questionable, however, whether we shall, with Bäumler, charge "any kind of irritation" with the production of gummous processes, or rather, in their stead, again the specific syphilitic virus.

Those who reject the view that the gummous process is produced by the syphilitic

virus in propria, base their opinion on the slighter infectiousness in the gummous stage. Indeed, in this period, syphilis is more rarely transferred to other persons than in the early papular period. But this rests only on external accidental circumstances. The gummous processes are almost always present in but few numbers at one time, and are situated on parts of the body unfavorable to the propagation ; while the numerous early efflorescences which preferably affect the mouth and the genitals, and withal are distinguished by a decided tendency to relapse, are naturally the chief propagators of syphilis ; as is well known, even more frequently than the primary affections, and for the same reason.

The possibility at least that gummous masses are infectious, as well as the secretions of the early period, has been recently demonstrated by Haensell by inoculations on animals. Moreover, I call to mind that Birch-Hirschfeld has made the discovery of the micro-organisms described by him, in gummata. Accordingly we hold that a direct co-operation of the bacteria of syphilis in the production of gummous products is at least of frequent occurrence, although no positive opinion can as yet be given as to the constancy of this fact.

If now we ourselves attempt an explanation of the variability of the several forms of syphilis, we must bear in mind :

In all syphilitic neoplasms without exception we have to deal, in the first stages of development, with a heap of granulation cells, no matter whether this process occurs earlier or later, or in whatever organ it may take place. It is the further developmental stages of this mass of cells which take different courses and lead to the formation of all the manifold forms which we "meet with in almost all organs as hard chancre, tubercles and abscesses, tubercular and gummous processes, interstitial formation of membranes, etc." Gummous, therefore, does not by any means designate a peculiar form of new-formation, but only that of decay.

What are the factors causing this difference in the development of the syphilomata ?

There is, in the first place, the active effect of the virus, which is :

First, an inflammatory one ;

Second, one specifically modifying the course of these inflammatory products ;

Third, an alteration manifesting itself in the entire organism—vessels, permanent tissue cells, etc.

This alteration of the tissues becomes an independent factor soon after the infection, whenever the disease has become constitutional ; a factor which has to be taken into account with every inquiry into the effect of the virus *per se*. Here we have not to deal with those so-called constitutional anomalies (scrofulosis, scurvy, etc.), but with a specific modification suffered by the tissues when they are poisoned with the SYPHILITIC VIRUS ITSELF.

This modification manifests itself at once in two directions :

1. In that only the healthy tissue (*i. e.*, before the infection and after perfect cure) possesses the capacity to form an "induration"—an essential difference from the later periods in which the products of all stages of syphilis are less variable histologically so that numerous transitional forms render nugatory any attempt at schematic classification.

Very remarkable indeed are the rare observations of reinfections (Merkel, Gascoyen) during still present gummous eruptions. However, they do not militate directly against the correctness of the view just defended ; they merely strengthen the view maintained by the above authors as well as by Finger, that in tertiary syphilis the diathesis, the general disease has disappeared, that

syphilis may have lost its character of a general nutritive disturbance, the symptoms present having the significance rather of a local sequela.

But how does the primary syphilitic affection look, and wherein lies the essential difference of the primary syphilitic tumor from all others?

The primary induration, the hard chancre, the initial sclerosis *per se* is an ordinary, granulation-cell tumor. The cells are derived from the vessels and are inflammatory, emigrated white blood-corpuscles which take on a specific course under the influence of the syphilitic virus; that is to say, they all develop rather quickly into an elongated, squat spindle cell with a small nucleus and relatively abundant mass of protoplasm. The vascular development is proportional to that of the cell-mass so that the tissue represents a very high degree of the inflammatory new-formation of tissue. The wavy connective tissue has nothing to do with the formation of the hard infiltration, but constitutes a fine, barely recognizable fibrillary network between the mass of the tumor consisting of closely packed cells; only here and there we see broader bundles interwoven between the cells—remnants of the tissue originally present. In the great majority of cases this cell-mass perishes before it has reached the terminal stage—common in normal inflammation not specifically influenced—of a fibrous connective tissue; according to our assumption, by the influence of the virus on the individual cells. The latter die, and at the same time the vessels become thrombosed and disappear. Blood pigment then remains for a time. (Exceptions occur in two directions: 1. Persistence of a cellular tumor for years, *i. e.*, transition to gumma; 2. Actual connective tissue new-formation, but also of a temporary nature.)

The great majority of the cells composing the granulation tumor are emigrated white blood-corpuscles. In recent stages this may be clearly recognized in the cellular tubes which traverse the tissue along all the vessels. The virus probably extends in the lymph sheaths surrounding the blood-vessels and thus causes the inflammation of the vessel-walls. Whether the thickening of the vessel-walls finally present is effected by the fixed cellular elements of these vessels themselves or by immigration is an open question. It seems the veins participate more largely than the small arteries.

Besides the migratory cells, however, there exists in the syphilitic primary ulcer also a hyperplastic process of the fixed connective-tissue cells. In the mass of the granulation tumor they cannot be recognized; but they are uncommonly numerous in the tissue beneath the induration, so that even in this connective tissue are found at times only these large, big, granulated, comparatively short cellular elements with large nuclei otherwise no spindle-shaped elements whatever, or at most migratory cells with their small granular nuclei. But it follows from this fact that in the case of these cells we are not dealing with immigrated and further developed elements. Were this the case, then the ordinary narrow spindle-cells of the connective tissue would be found by the side of the large cells and the lymphoid round cells.

These hyperplastic cells I take to be altogether specific for the hard chancre; not in a single instance have I failed to find them (they are especially well visible after staining with Bismarck brown, while they remain uncolored in strongly acid dahlia solutions, *i. e.*, they are no mast cells).

Whether they take part in the formation of the specific hardness I am unable to say. The latter seems to me to find sufficient explanation certainly in the spindle shape of the closely packed granulation cells.

How these enlarged cells are produced and what they really mean can of course not be positively decided. They might, on the one hand, owe their origin to a direct irritant effect of the

poison. On the other hand, according to the theory defended by Weigert, which denies primary "irritations" *in toto* and assumes only primary "noxæ," we would have to deal with a kind of necrosis with an imbition of tissue lymph rendered possible thereby. The decision of this point is still open. As has been stated, they are not the mast cells of Ehrlich, for they lack the specific granulation of the protoplasm and their characteristic color in strongly acid anilin solutions (especially dahlia). Possibly they are cells filled to repletion with the syphilitic micro-organisms.

Auspitz and Unna speak of a fibrillary hypertrophy of the connective tissue, with deposition of a collagenous substance, of a solid, little alterable product of young connective substance, and hold this hypertrophy of the fibrillary tissue to be the characteristic condition of the syphilitic initial sclerosis. The description given by the above-named authors is correct in itself for some specially advanced indurations in which there was not only a formation of spindle-cells, but also of fibrous connective tissue. But this "connective-tissue hypertrophy" exists only in isolated cases, while the cellular swelling is present in *every* one. I have examined scleroses not inferior in size to those described by Unna; but there was no trace of fibrillary connective tissue, nothing but spindle-cells. This condition could be demonstrated at first sight on preparations of (recently) boiled scleroses stained with picro-carmin. All fibrillary connective tissue obtains an intense red color by this method. Such red cords, however, occurred only as isolated narrow strips in the cellular tumor, the elements of which were closely packed and formed a compact mass only in the environment of the induration.

As to the microscopic difference between a hard and a soft chancre, this lies, in more advanced cases, in the spindle shape of all the cells forming the *hard* tumor, as opposed to the (less dense) infiltration with round and small (also more markedly stained) cells in chancroid; that is to say, in hard chancre we have inflammatory cells in progressive development; in soft chancre, the same cells necrosed by the virus of pus. In the early stages of both, in a series of clinically doubtful cases in which excisions were performed, I have never erred heretofore when forming the diagnosis from the presence of the hyperplastic connective-tissue cells. Wherever these were present, general syphilis broke out regularly, even in cases where the excision was performed at a time when no "induration" was as yet noticeable. When the large connective-tissue cells were absent, no matter how intense the infiltration, the process remained local. But these examinations are not definite enough to enable us to draw a positive conclusion. However, I believe I may be justified in concluding from these investigations why—aside from the primary affection of the lymphatic glands which had not been sufficiently attended to—the excisions did not furnish the desired positively curative result, why a secondary infiltration so frequently develops in the cicatrix of the wound which had closed by first intention. As far as the eye and palpation could determine, everything morbid seemed to have been removed. But the microscope showed that the connective-tissue cell-hyperplasia in the portion removed existed even in the lowest layers immediately adjoining the cut surface, so that we are forced to the conclusion that also the contiguous layers of connective tissue which had been left behind contained similar cell forms, *i. e.*, were likewise diseased.

Accordingly it will be necessary to excise more of the apparently healthy tissue, perhaps with microscopic control of the remaining connective tissue portions, or perhaps take into consideration an energetic cauterization of the excision wound surface.

In hard chancre, therefore, the action of the virus consists, on the one hand, in the formation of an inflammatory cell-mass which develops progressively only under the influence of the virus (spindle shape, at times connective tissue), but later perish by the action of the same virus; furthermore, in the hyperplasia of the cellular connective-tissue elements.

The alterations of the epithelium into active proliferative processes I hold to be "specific" neither here nor anywhere else.

The greatest analogy with the induration of the skin is presented by the endarteritis of the small arteries, the relation of which to the early processes we have pointed out above.

In all later new-formations there is an absence mainly of the hyperplasia of the connective-tissue cells which we have declared above to be the anatomical expression of the

completed syphilization of the tissues. But there is superadded to it the second factor which increases in importance with the longer duration of the disease—the chemical modification of the tissues, a greater liability to decay of the cell masses produced, anatomically indicated by the lesser degree of progressive devevelopment exhibited by the migratory cells. The cells, it is true, may become larger, epithelioid forms are found, but the "fibre-cell" is no longer developed.

The nature of this "modification" by syphilization may consist in, first, the fact that the cellular elements furnished by the body which constitute the syphiloma are from the start less viable and succumb more quickly to the necrosis induced subsequently by the virus than cells furnished by a healthy body.

Secondly, however, the modification may have influenced the growth of the vessels; they do not participate sufficiently by new-formation, as in a normal organism, in the nutrition of the granulation tumor; perhaps also the young vascular shoots are destroyed soon after their formation.

But if this new basis, the modification of the tissues, is once established, then again the variable intensity of the virus comes into action as the determining factor in shaping the several syphilitic processes, and it is mainly the changeable quantity of the virus circulating in the organism and coming into play locally at once.

We have already become familiar with similar relations in tuberculosis; they are also found in vaccination. A. Nourney made experiments with diluted lymph, with punctiform inoculation in very small incisions, whereby the quantity of the virus introduced into the wound was diminished. It was found that: 1. the duration of the course of the inoculation undoubtedly depends on the quantity of the virus introduced, the onset of the vaccinal fever, the appearance of the areola being delayed two or three days by diminution of the virus; 2. diminution of the virus causes in most cases a lesser maximum of fever and certainly a more circumscribed expansion of the areola; 3. general infection is brought about immediately with the inoculation; 4. the rapidity of the reproduction of the virus in the organism seems to stand in causal connection with the local phenomena.

The quantity circulating at any one time is greater in the periods closer to the infection than it is subsequently; but locally smaller numbers of bacteria usually come into action. Hence the early exanthems are more numerous, more disseminated over the body, and acute in their onset. Within a few days a small granulation tumor arises with copious vascular development so that the persistence of the neoplasm is assured for a certain time. Not until weeks afterwards do the cells and vessels gradually perish so that finally a complete *restitutio ad integrum* ensues. The analogy of these formations with the primary affection is obvious; in both there are comparatively high further development of the several cellular elements, sufficient vessel formation, healing by absorption of the neoplasm without loss of substance.

The course of the gummous form is altogether different! At very few places a slow tardy accumulation of exudation corpuscles with sparse development of vessels. This mass may remain unchanged for months until finally the cells, the development of which was very moderate from the start, perish. But the tissue in which the tumor was embedded is implicated in this disintegration, and thus results a defect healing only with cicatrix, etc.

It cannot be positively decided whether these defects of tissue are merely processes of deliquescence due to the necrosing mass of the tumor, or whether we have to deal with a simultaneous primary necrosis of the constituents of tissue by the virus itself. In the case of gummata it seems to me untenable to assume the direct necrosis of tissue. The possibility of causing even large "gummous" new-formations to regress by appro-

priate early treatment, without any damage to the mother tissue, indicates that this gumma consisted only of newly superadded cells, after the removal of which the previous state was re-established. Only when the (newly superadded) cell mass perishes, does the destruction in the fundamental tissue commence.

The disintegration of the tumor begins in the centre with a necrosis of the cells corresponding to the necrosis of coagulation (Weigert): destruction of the nuclei, coagulation of the cellular protoplasm. Accordingly the whole cellular new-formation becomes necrosed, but in a variable manner depending on external circumstances: in the superficial gummata, with very early and great fatty degeneration of the infiltration cells; in the subcutaneous connective tissue with melting down of the contents by the formation of a tough, mucoid ("gummous") substance, occasionally with subsequent ulceration; in the internal organs, in which "strong rugous thickenings of the tissue have taken place round about," with the formation of a dry, cheesy, pultaceous, more persistent patch.

I hold this persistent, permanent connective-tissue new-formation surrounding the gumma to stand in no relation whatever to the virus itself. It arises around the necrotic syphilitic patch as it does around every dead patch in process of absorption, nomatter how it originated. The same interpretation I apply to the giant cells of the gummata. They are a sign of the attempt at reproduction of the surrounding connective tissue having no character specific of the syphilitic virus.

Years ago I made investigations into the regenerative capacity of liver substance, a necrotic focus having been produced in the liver tissue by the injection of a drop of concentrated carbolic acid. Subsequent examination showed conditions absolutely parallel to those of a gummous affection of the liver.

Owing to their tendency to decay, gummata are to be interpreted patho-anatomically as malignant products of syphilis. But looked at clinically they lose this malignant character, because, if recognized in time, they offer less difficulties to treatment than the early forms which are benign *per se*. Of course, it must not be overlooked that it is just this "early recognition" which is often rendered very difficult by the exceedingly chronic and insidious course. A recognized and correctly treated gumma does no damage to the tissue affected; left to itself, the tumor and the corresponding mother tissue disintegrate. Altogether the syphilitic virus, in the majority of cases, is relatively benign, because it generally limits its effect locally, and therefore permits the reparative efforts of the organs, consisting in inflammatory connective-tissue formation, to take place unhindered. Exceptions occur here likewise, for instance in the serpiginous syphilide of the skin, in certain interstitial affections of the liver, etc. But even such cases may heal spontaneously, although they leave permanent defects and cicatrices.

We must here in a few words touch upon the chemical difference between the papular and gummous formations; namely, the well-known absorption which gummous infiltrations undergo by the use of potassium iodide, as opposed to the slight and rarely observable influence of the same agent on the products of the early period. These latter again heal more quickly under the use of mercurial preparations which, though they aid in the treatment of gummous syphilis, do not approach the effectiveness of iodine. The effect of potassium iodide on gummata is almost equivalent in its positiveness to a chemical reaction. Well-known and constant as this fact is, its explanation is still to be furnished; but the fact is so certain that we, inversely, employ the absorbability of gummous tumors by iodine as a proof of the slight viability of their cells.

Altogether, as regards the employment of mercury, as well as that of potassium iodide, we are absolutely on an empirical standpoint. To mercury we ascribe a direct effect on the virus, to iodine the power of furthering the absorption of the products of syphilis. This view indeed is supported by clinical observation. Fournier especially is its advocate, and again and again emphasizes the doctrine that the course of syphilis, as a rule, depends on the treatment instituted; that the production of late gummous symptoms is due to inadequate mercurial treatment; that syphilis as a chronic disease requires a chronic treatment.

Quite different, however, is the course of a third group of eruptions which otherwise are included sometimes among the early (or secondary), sometimes among the late (gummous) forms, but which, according to their course and character, can be erected into a special class. I mean the processes progressing with so-called "suppuration," such as develop especially on the skin in the shape of pustular, bullous, and ulcerous forms, in the intestines as "abscesses." We seek their cause in an especially large quantity of bacteria at once overwhelming the organism, hence their destructive local effect, as well as their consequences which threaten the integrity of the system as a whole. On the other hand, not rarely an existing disease (tuberculosis, etc.) is the cause of the acute necrotic disintegration of the syphilitic products. The local processes have this in common with the gummous processes, that they, if left to themselves, are followed by permanent losses of substance; they differ from them and approach the papular forms by their very rapid course, new-formation and decay being effected in a very short space of time, and finally in that there is almost no treatment which can prevent the disintegration. (Mercury is powerless against so large a quantity of bacteria and otherwise injures the organism already attacked by the syphilitic virus.) From all this—aside from the not uncommon implication of the entire organism—it follows as a natural sequence that these syphilides possess a characteristic malignancy, and that we are justified in separating this group both from the papular and the gummous neoplasms. But it must be remembered at the same time that every papule and gumma, by the supervention of external accidents, may "suppurate," *i. e.*, necrose more rapidly than is usually the case.

Here again the question arises: In what manner does the virus act? Does it produce only a very acute inflammation which at once prevents any attempt at organization, or does it effect, besides this inflamation, direct necrosis of tissue? A decided answer cannot be given, even if we were to ascribe a part to the "specific tissue alterations." The actual facts are, a rapidly progressing infiltration with inflammatory cells fills the tissue, and this infiltration perishes together with the basis substance. At the periphery the course is slower; here syphilitic new-formation takes place which may be preserved from the destruction going on at the centre, by appropriate measures.

In other cases—I have in mind here the bullous syphilide in hereditary lues—the intensity of the virulence manifests itself by the dissolution of the coherence existing between the papilla and the epithelial layer. From above and below there project into the bulla the conical processes of the two otherwise interlocked layers. The form of hemorrhagic syphilide will likewise hardly find a better interpretation than by a special violence in the activity of the virus on the vessel walls.

Under this head belong finally the acute abscess formations in internal organs (*e. g.*, of the thymus gland), the joints, the bones in hereditary syphilis. Incidentally they also teach us the unity of all syphilitic neoplastic processes which differ only in their terminations, and then in their extreme forms permit of a strict classification, while the

majority of the formations represent intermediate and transitional steps, and appear to belong now more to the one, now to the other type.

However, we know two clinical forms of particularly malignant syphilis ; one in the true hereditary form transmitted by semen and ovum, the other in the so-called "galloping" syphilis in acquired disease. The latter is characterized by the rapid development —beginning a few months after infection—of destructive (pustular and ulcerating) efflorescences which, in rapid succession and often in very great numbers, uninfluenced by our otherwise effective treatment, frequently enough jeopardize the life of the patient.

This clinical form of "galloping" syphilis has specially received the name of "malignant syphilis" and therefore is not to be confounded with "grave" syphilis (as, for instance, syphilis of the brain, etc.) It may also be emphasized here that it is erroneous, in this galloping syphilis, to speak of "gummous" processes. Precisely the essential characteristic of gummata, the insidious development and the slow, indolent course, is lacking.

Furthermore, hereditary syphilis is certainly the highest degree of infection that could be imagined, which will be evident at first sight from the insignificant number of syphilitic fœtuses who maintain life.

Wherein, in these two categories, are we to seek the reason of the malignant, grave course ?

In the first place, as to the hereditary form, I think I must inculpate the quantity of the virus at once overwhelming the organism. The idea suggests itself to make the weak organism, incapable of resisting, responsible for the grave character of the disease. It should be considered, however, as opposed to this view, that acquired syphilis, in children but a few months old, does not by any means run a malignant course.

Besides, I know of no better way to explain the varying intensity of inherited syphilis, which decreases in malignancy in proportion to the increasing age of the parental syphilis, than by the gradually lessening quantity (partly spontaneously, partly temporarily by mercurial treatment) of the virus present in the parents and transmitted to the offspring.

Again, as to galloping syphilis, the attempt to find the cause of this unusual course in the debilitated, non-resistant quality of the body, could not be made to harmonize with clinical experience.

No support has been offered for the view that there are specific qualities of the virus (that is, qualitative differences). But we know an epoch in which syphilis exhibited only the character described as the "malignant" form, namely, its spread throughout all European countries at the end of the fifteenth century and the succeeding decades. The study of this epoch brings us nearer to the view of the qualitative differences between the virus of that time and that of to-day.

To explain this malignancy, the factor hitherto relied upon—the varying quantity of the virus—does not suffice.

However, in the discussion of this question two points of view, not mentioned above, come into consideration; namely, the immunity against a second infection acquired by one attack of the disease, and besides, the hereditary quality of the disease as well as of the immunity.

It is a fact observed also in other infectious diseases that epidemics which have for decades taken root among nations and produce comparatively benign affections, appear as malignant diseases when they attack a people for the first time. Instances are fur-

nished by the first appearance of measles on the Faroe Islands, the introduction of leprosy into the Sandwich Islands.

This explains to us the malignany of syphilis on its first appearance in Europe when contrasted with the present benign course in the majority of instances; they also give an explanation of the varying character of the disease in the several European countries.

The same conditions in respect to syphilis are said to prevail, for instance, in Spain. There syphilis takes a remarkably mild course which manifests itself especially in the very small number of hereditarily syphilitic children. The cause of this feature is attributed to the immense spread of syphilis for generations in all classes of the populace.

Does this enfeeblement of the disease rest on a gradual decrease of the malignancy of the virus; or on an increasing power of resistance?

Both are likely. It may be, too, that both conditions stand in a certain correlation.

Let us consider the latter point: the power of resistance to the infection; this would reach its highest degree in the incapability of being affected at all. Man does not possess this immunity spontaneously, but it is acquired when a person has passed through a syphilitic disease; a new infection then is as good as excluded, a fact borne out by the small number of real reinfections against the great many cured cases of syphilis. This "immunity" exists indubitably, and in syphilis we even possess, in the above-described difference between a primary induration and a syphilitic papule, an anatomical landmark of the modification of the tissues representing the immunity: in the indurated ulcer, hyperplastic connective-tissue cells which no longer occur in later forms of syphilis.

If this acquired immunity could be transmitted to posterity in its original strength, the succeeding generation would be protected against syphilis. This is not the case, any more than other acquired qualities are transmitted unmodified. But a certain degree of "modification" has been inherited, which has already led to a greater resistance toward the effect of the (originally unchanged) syphilitic virus. But if this generation is infected, there occurs at the same time a weakening of the virus. The latter is, as it were, under less favorable nutritive conditions, and hence its quality is weakened.

(So also are reinfections always more benign than the first attack, in syphilis, measles, scarlatina, etc.)

Let us picture to ourselves these processes: increase in the power of resistance and thereby weakening of the virus in the progressively less favorable soil, continued through many generations, would easily explain the diminution of the malignancy in nations thus affected.

The diminished malignancy of the entire character of the disease of to-day against that of old, therefore, could well be due to the continued transmission of the immunity. But this leads not so much to an increased power of resistance against the syphilitic virus as to a lessening of the intensity of the virus, because the latter has developed under progressively less favorable conditions from generation to generation. A diminished virulence of the virus, therefore, is the permanent result attained by syphilis transmitted through generations. The resistance acquired by the single individual toward the effect of an unmodified virus is of less importance. Thus the disease of a German who became infected in Spain is benign because, in that country, the syphilitic virus has gradually attained a greater benignancy; while the Europeans who acquire the disease, for instance, in China, suffer from it in almost the same malignant way as the Chinese. The cause of this malignancy of syphilis in China is ascribed by authors to the fact that the disease is

left entirely unheeded, receiving no treatment. This brings us to another factor to which we must concede the capacity of diminishing the virulence of the poison—the influence of therapeutics. Just as the latter is able in a single case to modify the course of the disease—so it likewise modifies in the course of generations the character of the virus, in the manner above explained.

It remains for us to consider the immunity enjoyed by those apparently healthy women who, without showing any objectively demonstrable signs of syphilis, have borne children hereditarily syphilitic from the father's side, and in the great majority of cases are exempt from infection. Experience teaches that these women may nurse their hereditarily syphilitic children without danger, while the infection of healthy wet-nurses by such children is not of rare occurrence. Have we to deal in such cases with immunity or disease of the women? Hutchinson is inclined to assume the latter, from a gradual poisoning of the maternal organism by the fœtus. This view is based on the observation of tertiary (gummous) processes occurring in later years, without any secondary or even primary symptoms having ever been present.

It is also possible to imagine immunity without disease, similar to the immunity toward variola which is acquired, not by variola, but by vaccinia.

It still remains for us to state that the above relations between mother and child may also manifest itself in the opposite direction, in this way, that the syphilis of a woman acquired after conception may render the fœtus insusceptible to later infection.

As regards the hereditary transmissibility of syphilis, it can be brought into perfect harmony with the bacterial nature of the syphilitic virus. This applies to the two modes ordinarily designated the "heredity" of syphilis; we understand by it, on the one hand, the infection of the first germ, whether by the semen of a syphilitic father or the ovule of the diseased mother, or both, *i. e.*, "genuine heredity." On the other hand, however, we apply this term also to "intra-uterine infection of the fœtus, healthy by conception, by syphilis acquired after conception by the mother"—a rare occurrence, but one nevertheless positively observed. This latter possibility appeared improbable to some authors because the "fixed" syphilitic contagium was said to be unable to pass through the septa between maternal and fœtal placenta. But since Spitz has furnished the proof that the spirilla of relapsing fever are able to pass that way, and since the same power has been demonstrated in the bacilli of anthrax, nobody will, at least *a priori*, deny the similar property to the bacteria of the syphilis.

In proof of the transmissibility of syphilis by semen and ovum, we refer to the analogy with the corpuscular disease of the silk-worm. This disease (pebrine, gastine) is an epidemic, infectious, and hereditary affection during which are found in the blood and in all organs of the diseased caterpillar small glossy corpuscles (corpuscles of the cornalia) which have been recognized as schizomycetes. These (remarkably large) cocci, however, occur also within the ovum from which the diseased young animals are developed. Furthermore we are indebted to Pasteur for the experimental demonstration that the heredity of the corpuscles takes place also when an affected father impregnates the healthy mother, and the latter, remaining healthy, lays diseased eggs (paternal infection); also, when the mother is affected and lays diseased eggs.

Now, what has been observed with these large cocci of pebrine is at least conceivable for the organisms of syphilis!

We have already spoken of the various degrees of intensity of the syphilis occurring in fœtuses and its regular moderation (proportional to the increasing age of the disease

in the parents). But a few words must be added about the form termed tardy hereditary syphilis.

Although it has been much talked about, the fact is that there is no positively authenticated case of this tardy form on record. By tardy hereditary syphilis we understand a form appearing with the symptoms of the late stage of syphilis (gummous pharyngeal and nasal ulcerations, swellings of the bones, etc.), from five to ten or more years after birth, without having previously shown any indication of the disease. Theoretically we might explain these cases, inasmuch as they are analogous to those gummous affections which, in acquired syphilis, may follow the early forms after an interval of years, sometimes even of decades. Hence we should have to deal with hereditarily transmitted germs which have always remained latent, and besides, with that alteration of the tissue which we felt forced to presuppose in the case of gummous processes. This anomaly of tissue and its origin in tardy syphilis we could relegate back, first, to syphilis of the semen or ovule which from the beginning would have to create pathological tissues in a specific manner. Second, in the case of infection, if comparatively weak, of a fœtus of healthy conception, taking place in utero by way of the placental interchange of blood, the absence of early symptoms of a syphilis manifesting itself subsequently would seem capable of explanation. It is well known that Hutchinson has suggested a similar theory of the transmission of virus in explanation of *choc-en-retour* (*i. e.*, infection of the mother by an *a patre* syphilitic fœtus).

But in none of the cases of so-called tardy syphilis thus far reported can preceding disease (without early forms) be positively excluded. There is always an absence of non-syphilitic history attested by accurate medical observations. For of course little reliance is to be placed on the statements of the patients or their relatives that the children have always been healthy. Another source of error lies in disregarding the exceedingly frequent occurrence of syphilis acquired in the first years of life. I content myself with enumerating briefly the most frequent modes of infection : infection during the passage through the parturient canal ; from the midwife ; from the wet-nurse ; from domestics ; from relatives by means of kissing, sleeping in the same bed, etc.; during vaccination ; during ritual circumcision ; by attempted rape, etc.

If we add to all this the comparatively great benignancy of infantile, acquired syphilis, especially under proper treatment, we shall not be surprised that tertiary symptoms are interpreted as tardy hereditary syphilis, because the infection could no longer be traced.

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Surveying again the entire picture of syphilis from our standpoint, we obtain the following theses :

I. *Infection.* The bacteria enter the organism at any part of the surface of the body where the lack of epidermis or epithelium permits penetration into the plasmatic channels.

The virus remains then at the point of infection, but some germs at once enter the circulation and rest in the lymphatic glands appertaining to the point of infection.

II. Then follows the stage of the first incubation, during which nothing can be noticed of the presence and effect of the bacteria ; but in that time increase of the bacteria certainly takes place at the point of infection and the neighboring lymphatic glands ; finally, formation of the primary affection and swelling of the primary lymphatic glands.

III. Saturation of the organism by the bacteria multiplying in the primary affection and in the lymphatic glands.

IV. Gradual disease of the several systems: glands, skin, mucous membrane, etc. The glands become the depositories of the bacteria and harbor them in the so-called latent periods.

V. Either spontaneously or by energetic, persistent treatment these germs are finally destroyed, or else the germs are preserved, and,

VI. Relapses follow the intervals of latency, larger quantities of the bacteria again gaining access to the circulation.

VII. The nearer to the date of infection, the larger is the number of the bacteria present in the body. Hence in later periods:

1. Gradual decrease in infectiousness.
2. Gradual decrease in the capacity of hereditary transmission.
3. Rarer and but isolated occurrence of foci of disease.

VIII. At the same time there has been gradually developed, perhaps by chemical by-products of the bacteria, a modification of the tissues which in later stages forms the basis for the gummous forms.

IX. Mercury is a direct poison for the bacteria of syphilis and, if used in sufficient quantity and for a long time, is capable of preventing the development of the gummous stage. Potassium iodide furthers the absorption of the neoplasms; those of the early stage in a slighter degree, most strikingly those of the gummous stage.

Respecting the varying malignancy of the disease, aside from constitutional anomalies originally present, there enter into the consideration:

1. Chiefly the QUANTITY of the virus at once overwhelming the organism; hence the dependence of the course on the energy of the treatment (see IX.).

2. Possibly also a changing quality[1] of the virus, which might have suffered a weak-

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[1] In reference to the changing quality, *i. e.*, the variable malignancy of one and the same fungus, we have only lately again acquired more positive information. Pasteur, Toussaint, and Chauveau had previously found that it was possible, by specially arranging the experiments, particularly by increasing the temperature of incubation, to deprive the fungi of anthrax more and more of their virulence, so that after some weeks they finally became altogether harmless. Withal, the morphological qualities and propagative powers remain unchanged. Fungi thus modified even transmit their respective degrees of virulence to their descendants. Koch ("Ueber die Milzbrandimpfung. Eine Entgegnung auf den von Pasteur in Genf gehaltenen Vortrag," 1881) has recently confirmed these experiments, and therefore, in the doctrine of infection, we must henceforth take into account a changing virulence of morphologically identical bacteria, depending on external conditions.

Besides the temperature, there is certainly a whole series of other factors (*e. g.*, acquired and inherited immunity) which modify the development and the qualities of bacteria. It has long been known that not every animal species is receptive of any and every disease; we have even learned that closely related animals, such as field and domestic mice, or various races of sheep, react differently on the same virus, and hence it will appear plausible that different human races show similar variations, or even that within the same race the receptivity of the several individuals for the disease-producers is not always the same. The history of leprosy, of yellow fever, scarlatina, typhoid fever, etc., abundantly illustrate what has been set forth above. In fact, this circumstance is nothing else but what we continually observe in the cultivation of bacteria, viz., that even the most insignificant alterations of the experimental conditions may influence or retard the development of the organisms. (Comp. the very commendable essay by Lichtheim, "Ueber den gegenwärtigen Standpunkt der Pilzlehre mit Rücksicht auf die Infectionskrankheiten," in *Aerztl. Vereinsblatt*, March, 1883, pp. 53 et seq.)

ening by the immunity due to previous disease and further hereditary transmission of this immunity in the course of many generations.

## IV. GLANDERS.

For the description of "glanders" malleus I refer to the paper by Bollinger in Vol. III. of this Handbook. A detailed discussion appeared superfluous, because Bollinger shares our conviction, culminating in this, that in glanders we have to deal with fixed, *i. e.*, organized contagia, and because, since the publication of his essay, our knowledge of the nature of the contagium has, unfortunately, not been widened.

### Postscript.

I abstract from the *Deutsche Medicinische Wochenschrift* a "preliminary communication on the labors of the Imperial Board of Health by Dr. Struck, which have led to the discovery of the bacillus of glanders:"

In the first place, a certain form of bacteria was searched for in the specific products of glanders, the so-called farcy buds, by staining sections of tissue from the lungs, spleen, liver, and nasal septum of a horse killed on account of glanders. In specimens stained with a concentrated aqueous solution of methyl-blue, afterwards treated with greatly diluted acetic acid, dehydrated in alcohol, and embedded in oil of cedar, there were found now and then slender rods having about the size of the bacilli of tuberculosis; no other forms of bacteria were present in the specific products. In order to determine whether these bacilli stood in causal relation to glanders, cultivation was resorted to.

On the 14th of September, according to what Koch has taught with reference to the cultivation of the bacilli of tuberculosis, a number of sterilized reagent-glasses containing horse or sheep blood serum were charged with particles carefully selected from glanders tubercles from the lungs and spleen of a horse killed because of glanders. In the first two days no changes were noticed. But on the third day there were noticed in the majority of the glasses numerous small translucent little drops which had formed scattered on the surface of the serum. These contained, as shown by staining them on the covering glass, countless fine bacilli of the above-mentioned size. Inasmuch as the drop existed uniformly in nearly all of the culture vessels, and only this one species of bacteria had developed in them, the experimenters were inclined to test these bacilli immediately in reference to their original relations to glanders by reinoculation into animals receptive of the disease.

But in order to meet the objection, if the transmission should be successful, that the inoculating material perhaps still contained particles of the original charge of glanders material, the cultivations were continued for a month through four generations.

From the resulting fourth cultivation, containing nothing but the above-described fine bacilli, a small quantity was abstracted on October 14th, and inoculated into the pituitary membrane and into both shoulders of an old, otherwise apparently healthy horse. After forty-eight hours the animal began to be very feverish; at the points of inoculation deep ulcers developed, from which knotty cords of lymphatic vessels extended to the swollen glands of the throat and shoulders, so that about a week after inoculation the horse presented the pronounced clinical picture of glanders. After about one month, the ulcers began to cicatrize, the glandular swelling decreased, the animal appeared also to have improved so that it became doubtful whether the symptoms after inoculation should be actually interpreted as glanderous. On November 25th the animal was killed, and the post-mortem yielded a most surprising result. On the nasal septum as well as on the points of transition from the nasal into the pharyngeal cavity there were numerous white, in part stellate nodes; in the lungs, old fibrous, likewise calcified nodes, but, besides, some quite fresh gray nodes with a red areola, and at the root of the lung a glanderous growth about the size of an apple.

Judging from this result, the animal had formerly recovered from an infection of glanders. That the recent eruptions were to be attributed to the artificial infection could not be positively asserted. But, as it furnished recent glanderous material, the latter was used in securing fresh cultivations. From these were again developed, after three days translucent droplets containing solely the above-described bacilli.

The same bacilli were found, besides, in the recent glanderous products of the dissected horse, after they had been treated with methylene blue.

Again, in the course of November, the fresh organs of a horse killed on account of glanders were examined. It was likewise possible to cultivate the same bacilliferous droplets from the glanderous nodes present in the liver of this animal. Finally, on the 1st of December, successful cultivations were made from fresh glanderous nodes of a fourth case. The result was always the same.

In the mean time the pure cultivations of the bacilli were also successfully inoculated into other species of animals that were at hand, namely, rabbits, mice, and guinea-pigs.

The rabbits reacted variously: while some animals on dissection exhibited merely local ulcers and swelling of the corresponding glands, others showed the pronounced picture of glanders. The inoculations with cultivated glanderous material into white mice, otherwise exceedingly receptive of infections of all kinds, gave negative results. Positive results, however, were obtained by the inoculation of field mice.

The results of the inoculation of guinea-pigs were surprising. Here the course of the disease varied in rapidity corresponding to the quantity of the cultivated material injected. Invariably by the third or fourth day an ulcer with greatly indurated margin developed at the point of inoculation; then the corresponding lymphatic glands began to swell to the size of a hazel-nut, or even to that of a chestnut. In many animals the process remained for weeks in this stage—probably the contagium was retained in the glands—but in others, especially those which had received a large quantity of bacteria subcutaneously, acute nodular swellings developed in the testicles, or else the ovaries or the vulva. At the same time some of the feet presented nodular swellings which latter also appeared on several parts of the skin, or else ulcerative processes developed in the nasal cavity which even led to perforation of the bone toward the outside. Finally, in some of the animals a general infection was suddenly developed which rapidly ended fatally. In such cases, especially the spleen and the lungs were interspersed with innumerable submiliary gray nodules bearing a great resemblance to miliary tubercles. These exhibited the fine bacilli found in glanderous products of the horse. All these alterations manifested their glanderous character, besides, by exhibiting the same phenomena which are observed in glanders of the horse—the metastases in the testicles of stallions, as well as the inflammations in the marrow of the bones which have their seat particularly in the ribs of horses, belong to the typical picture of glanders. The cultivations from all these organs—testicles, spleen, lungs, etc.—furnished always the same, above-described pure cultivations, which had been obtained in four different cases from the various organs of glandered horses.

Although these results rendered it exceedingly probable that the bacilli are the cause of glanders, the decisive reinoculation of pure cultures into horses was still lacking. Therefore two healthy horses were inoculated on November 28th with pure cultivated bacilli. The inoculating material for the older animal was the eighth generation cultivated for ten weeks outside of the animal body from the pure cultures obtained on the 14th of September; that for the younger animal was a cultivation which had been obtained from the testicle of a guinea-pig inoculated with the fourth generation of the culture from the 14th of September and which had died on November 8th, the cultivation having been continued through five more generations outside of the animal body. In order to obtain the most rapid infection possible, injections were made on both sides of the neck, the breast, in the flanks, and, in the younger animal, also on the dorsum of the nose. The Schneiderian membrane was not touched in order to ascertain whether secondary eruptions would develop on the intact mucous membrane. A few days later, the points of injection showed diffuse, doughy swellings on both animals. The animals were off their feed, their legs became stiff, and their coat rough. After about a week, cords like strings of beads could be felt extending along the skin to the corresponding glands, in both animals. The swellings had broken and secreted a turbid yellowish-green fluid. On the twelfth day, besides the former symptoms, there was observed on the young horse an ulcer in the skin of the forehead, about the size of a silver quarter, which had penetrated to the frontal

bone and exhibited elevated margins. Withal both animals had a discharge from the nostrils which dried on the edges into thin yellowish crusts; finally small ulcers with elevated margins had formed on the pituitary membrane.

Both animals continued falling off from day to day, and on December 12th the older one died.

The post-mortem yielded the following results:

On all the points of inoculation, ulcers, the size of a quarter-dollar and larger, had formed. The ulcers were covered with thick crusts consisting of the dried products of secretion and hairs, and a yellowish-white fluid exuded by the side of the crusts. The soft parts beside and beneath the ulcers were pasty and fluid. The corium around the ulcers was infiltrated with purulent fluid and had become detached from the underlying parts. The ulcers on the neck were connected with cords of lymphatic vessels the thickness of a finger which extended to the glands of the shoulder. The latter had nearly the circumference of a hen's egg and their reddened and moist tissue contained small yellow or yellowish-white patches. From the other points of inoculation, too, cords of lymphatic vessels could be followed as far as the neighboring lymphatic glands. On the former, it was possible to demonstrate here and there a soft, yellowish-white, almost fluid node ranging from the size of a pea to that of a bean. The axillary and inguinal glands were swollen, soft, and likewise interspersed with the above-mentioned yellow patches. The mucosa of the nasal septum and of the turbinated bones was the seat of ulcers having eroded borders. In the latter and at the bottom of the ulcers, small yellow or gray nodules were found. The submaxillary lymphatic glands contained nodes the size of beans and up to that of a hazel-nut which inclosed yellow patches. In the mucosa at the anterior surface of the epiglottis was an ulcer the size of a dime which had elevated margins. In the lungs were found countless nodules from the size of a millet-seed to that of a pea, of which the larger were due to the confluence of smaller ones. The latter contained a gray, turbid centre surrounded by a reddened areola. In many of the muscles of the body were nodes of different sizes consisting of a yellowish-white, pasty, often fluid mass.

Inasmuch as the result in the older animal was so positive, the younger one, which then already exhibited great debility, was killed on December 13th. At the post-mortem, performed immediately afterward, the following alterations were found.

At the points of inoculation, large ulcers secreting a thin, yellowish-white fluid. The sore on the dorsum of the nose was as large as a dollar, and extended down to the periosteum of the upper maxilla and of the nasal bone. The ulcer which had formed close to this point of inoculation in the skin of the frontal region was somewhat smaller, and its bottom covered with bloody masses. Several smaller ulcers were also found in the skin of the right thigh, and one on the sheath. From the ulcers situated on the upper part of the neck, cords of lymphatic vessels, set with nodes and as thick as a finger, could be followed as far as the swollen glands of the shoulder. The nodes, which lay partly in, partly alongside the lymph-vessels, contained a pus-like fluid. The shoulder-glands were the size of a hen's egg, soft, and inclosed a number of small grayish-yellow patches. From the sores which had formed on the chest after inoculation, the ulceration extended deeply into the corium and the muscles. From them several cords of lymphatic vessels the thickness of a goose quill extended to the axillary glands. The latter were as large as a walnut and contained several yellowish-white patches the size of a millet-seed. The ulcers at the points of inoculation in the region of the flanks were shallow, and the tissue in their neighborhood was infiltrated with a turbid fluid. The lower end of the right thigh was swollen, especially near the ulcers which had their seat on the external side of the posterior metatarsus.

The right inguinal gland had the circumference of a hen's egg; it was soft, juicy, and reddish in color; the left inguinal gland, though similarly altered, was of smaller dimensions. The subcutaneous tissue of the sheath was of a gelatinous consistence, and the lymphatic glands situated therein were enlarged. The ulcer on the sheath extended into the subcutis. Several muscles contained cavities of different size which were filled with a yellowish-white turbid fluid. A cavity in the semi-membranosus was as large as a fist, and contained also a necrotic piece of muscle the length of a digital phalanx.

The mucosa of both nostrils was set with numerous nodules and ulcers; the former partly gray, partly yellow in color. Here and there, by the deposition of the nodules, flower-bed-like swellings, with undulating surfaces, had formed; the ulcers due to disintegration of the nodules had their eroded margins and bottoms covered with fresh nodules. The mucosa around the ulcers was

injected. The edges of the spongy bones and the uppermost portions of the nasal passages were most largely affected. The submaxillary lymphatic glands were the size of walnuts, firm, movable red on section, and interspersed with several yellowish-white patches. In the lungs were found six nodules of millet-seed size, having a gray centre and a reddened periphery. In the latter the parenchyma of the lung was rather firmer and moister. The anterior mediastinal and the bronchial lymphatic glands were enlarged, soft, and juicy. The spleen was slightly enlarged, and its parenchyma soft and blackish-brown. Liver, kidneys, heart, and the muscles of the trunk presented the appearances of a slight cloudy swelling.

These investigations have been quickly confirmed by a work undertaken by Israël at the Pathological Institution in Berlin.

## V. TRACHOMA.

This affection occupies one of the principal places among contagious diseases, in spite of some exceptional conditions. Recently Sattler has also described micrococci (as well as experimental inoculations with their cultures), which he interprets as the pathogenetic micro-organisms of trachoma. Anatomically, the granulating disease of the conjunctiva can be set down as a type of a leucocythoma: spherical patches of round cells, between which extends a network of the most delicate fibrillæ, spring up between the epithelial cones penetrating into the depth which probably represent also the septa between the microscopically recognizable granules. The vascular dilatation and formation of mast-cells in the deeper, loose connective tissue is of a very high degree. The development of vessels into the granulomata seems to be very sparse. I have not seen a true necrosis of coagulation in the small nodules, but have observed in its stead another degenerative process affecting the protoplasm. The nuclei perish and can no longer be stained, some of them disintegrate into the smallest particles; the protoplasm of the cells clears, only the outlines of the cells remaining visible, so that one of these spots makes the impression of a network composed of exceedingly delicate fibrillæ, which has taken the place of the granuloma aggregation.

Sattler had seen his micrococci in the tissue of the granulations, had described them as resembling the cocci of gonorrhœa, produced pure cultivations, and with these again had effected trachoma in man. Krause and I have examined numerous specimens of trachoma with absolutely negative results.

Therefore, the question of the bacteria of trachoma may still be considered an open one.

## VI. YAWS, FRAMBŒSIA TROPICA.

Frambœsia tropica, unknown among us, is a disease closely resembling syphilis, and termed by some authors a pseudo-venereal affection.

The disease is endemic among the negroes of the west coast of Africa. According to Lancereau, it is met with also in Senegal, Congo, Sierra Leone, and Nigritia. Milroy ascribes to it even a larger territory. Slavers transported it from Africa to the West Indies and the South American states. Besides, it is now spread among all the inhabitants of the Indian archipelago, the Malays (especially on Java), under the name of yaws or pian. In Peru it is known by the names of bubas and verrugas.

In general, the black and colored races are more subject to the disease than the white race—a fact which is easily explained by the better care of the skin and more favorable conditions of life in the latter.

In reference to the course of the disease, I follow the description of Pontoppidan.

The affection is a contagious disease of the skin, which appears in the shape of small nodules rising beneath the epidermis, without material disturbance of the general health; when the nodules have reached the size of peas, the covering epidermis desquamates, and the round, elevated, as it were nummulated tumors acquire a thick, firmly adherent, yellowish crust, resembling a dirty ivory faro check, or a round, smooth, button-like structure of cheese. When the crust is detached, there appears a weeping reddish, but not ulcerating, elevated surface, looking almost like a mucous papule. If it be greatly elevated and proliferating, or if it be treated with irritant drugs, it may approach the appearance of a raspberry. If the tumors have their seat in the ano-genital region, they may easily simulate mucous papules; but on parts more exposed to the air, the face and the extremities, for which they exhibit a preference, they always have their dirty-yellow, smooth crust.

Recently Charlouis has proposed the title polypapilloma tropica, and I can confirm the anatomical observations of this author from the microscopic specimens kindly forwarded to me. Anatomically, the tropical form is identical with the frambœsia occurring with us, which was described in 1869 by Kaposi as "frambœsia non-syphilitica" sive dermatitis papillomatosa capillitii, and which I myself have seen several times.

In both we find broad, not very high, flesh-red excrescences sessile on a flat base, with an uneven, raspberry-like surface, which bear the greatest resemblance to dry, syphilitic, broad condylomata, and microscopically, like them, prove to be proliferations of the rete Malpighii combined with inflammatory processes and enlargements of the corium and the papillæ. Therefore, neither the tropical form nor that observed among us belongs to the class of granulation tumors. But, inasmuch as we have laid down from the beginning the factor of infection with chronic course as the main characteristic of this entire group of affections, we claim that this disease has the right to be considered in this place.

I abstract from the Charlouis' treatise the following most essential points in the pathology of this disease.

1. Frambœsia is an infectious disease.

2. It is inoculable both on the patient and on healthy men.

3. The same person can be attacked several times by the disease.

4. Frambœsia patients, inoculated with matter from themselves or from others, develop either an ulcer resembling a soft chancre, or else a fungous tubercle. But these inoculations do not exercise the slightest influence on the existing disease

5. Both the secretion from the disintegrating neoplasms (tubercles) and the blood from the same is infectious, and the consequences of the inoculation of both are alike.

6. The virus is a fixed contagium, and can cause infection only by direct contact with the skin.

7. The neoplasms or their products are infectious only in their developmental stage or when at their acme; whenever they begin to dry up, infection is no longer possible.

8. The stage of incubation may last from three to five months.

9. Fever, accompanied by gastric disturbances and pains in the bones, precedes the eruption, and is associated with it for some time.

10. While the general infection is still recent, it is usually possible to approximately locate the place where the virus entered the body, because the nearest gland is the most enlarged.

I wish to add that the assertion formerly made, that frambœsia and syphilis are

identical, is erroneous. Both clinical observation and experimental inoculation have shown that both diseases may exist side by side or succeed one another. That the contagium of frambœsia is a bacterium will not be doubted in the present state of bacteriology, although the demonstration still remains to be furnished.

Indeed, wherever the disease is known it is recognized as contagious. "In Domingo it had spread so much that some years ago all yaws patients were seized by the police and immured in special hospitals until they were cured. It was found that when this procedure was rigorously carried out, the disease was materially diminished and its spread largely prevented. Almost invariably transmission from other yaws patients could be demonstrated as the cause of the affection."

In connection with frambœsia tropica we shall discuss the anatomically related frambœsia sive dermatitis papillomatosa capillitii (Kaposi).

By dermatitis papillaris capillitii we mean larger and smaller, many-furrowed, lobulo-acinous tumors, several millimetres in height, of very firm consistence, generally covered with thick epidermis, weeping only at some points, and usually situated on the hairy parts of the occiput and the borders of the nucha. Their size varies from that of a lentil to that of a quarter-dollar or even a dollar; at times the several nodes merge together into proliferations which may cover the surface of half the scalp. The surface shows a rose-red or bluish-red color; it is either bald, smooth, glossy, or covered with yellow crusts; now and then it secretes a sticky viscid fluid. The hairs project here and there, crowded into wisps or isolated, from the grooves and furrows of the uneven mass, but are lacking over the greater part of the latter. The individual hairs could be withdrawn only with difficulty. If some portions of the morbid tissue are removed with the scissors or knife, they creak on section. An abundance of blood exudes from numerous points on the cut surface. The patient feels no great pain either on pressure or on section. Hyde states that when an incision is made into the centre, a considerable quantity of pus wells forth. A sort of subcutaneous cavity forms which again and again fills with bloody fluid. Hyde believes the disease to be an inflammation of the deeper layers of the scalp. The duration in the cases observed was several years.

This affection belongs to the large class of new-formations termed frambœsia by Willan-Bateman, under which name these authors delineated only the tropical infectious disease resembling it anatomically. Besides it corresponds to the mycosis frambœsioides erected by Alibert who included it under syphilis. Really, however, it has nothing to do with syphilis. Hebra employed the name frambœsia for all irregularly verrucose papillary proliferations, no matter on what base they had arisen—on chronic ulcers of the foot, on lupus, on syphilitic ulcers, etc.

The ETIOLOGY is quite unknown. In a few cases the beginning of the new-formation followed a traumatic lesion leading to cicatrization.

The disease appears to be most nearly related to those cases of sycosis in which syconoid, fig-like proliferations have formed. But Kaposi disputes the relationship of the two processes. "There is an absence of all the essential symptoms of sycosis, *i. e.*, pustules from the points of which the hair projected which could have been pulled out with the greatest facility; the root-sheath of which appeared impregnated with pus; there is an absence of the reddened, slightly desquamating, almost eczematous parts of the skin." From the beginning we meet with firm nodules, of uniform consistence without pus.

(Mycosis fungoides Alibert, or the beer-fungus-like multiple papillary tumors of Köbner, are altogether different from this affection.)

TREATMENT.—Rationally this is purely surgical, viz., ablation of the neoplasms. Emplastrum hydrargyri is often very effective.

### PARANGI.

Under this name Dr. Kynsey has described a disease prevailing for years in Ceylon. It begins with a period of incubation during which an ulcer develops on some part of the body, and which is followed by a stage of invasion accompanied by fever and arthritic pains. This is succeeded by an eruptive stage which may last for weeks or months, and ends either in recovery or leads to the development of ulcerations, etc. This affection is contagious, being propagated by contact with the secretions of the ulcers (even on the intact skin); heredity is also assumed. After one attack there exists, it seems, immunity against fresh infections. Dr. Kynsey thinks the disease is certainly to be separated from syphilis and would rather suppose an identity with yaws.

## VII. RHINOSCLEROMA.

In reference to the etiology of rhinoscleroma, Prof. A. v. Frisch has made the following communication:

"My investigations on rhinoscleroma comprised twelve cases. By the kindness of professional friends, there were placed at my disposal excised portions of the diseased tissue, stained in alcohol, of six cases; the other six cases I had the opportunity of examining in the fresh state.

In all the cases, I found both in the cells and between them in the interfibrillary fissures of the connective tissue a certain species of bacteria which, under appropriate staining-methods, could be rendered visible.

These bacteria have a pronounced rod shape, but the individual rods are exceedingly short. The longitudinal diameter is about one and one-half times the dimension of the width. They were mostly found in rows of two. These relations are clearly recognized only by employing very high powers (Reichert's oil immersion $\frac{1}{20}$). Under low powers, they appear almost spherical, and they would be at once held to be cocci, were it not that attentive observation shows that their grouping into larger masses permits the recognition of an arrangement unusual with cocci.

The rods lie almost exclusively within the cells. Between the cells and in the fissures of the connective tissue they are rarely found. They are present most numerously and distinctly in those distended cells which exceed the diameter of the ordinary round cells three or four times. Mikulicz, who describes these peculiarly distended cells in detail (l. c., p. 509), believes them to be round cells in regressive metamorphosis. It seems to me quite probable that this metamorphosis is to be traced directly to the reception and the influence of these bacteria. It is easy (often in the same field) to follow all the transitions from the ordinary round cell to the terminal stages of these altered cells. Round cells containing but few (two or three) rods, and exhibiting a well-stained nucleus, lie by the side of such as have but little increased in size, but the protoplasm of which shows more or less distinct granulation, and the nucleus of which is only faintly visible, or has entirely disappeared. Close by are cells of double, treble, or even quadruple and quintuple the size, in which the granulation of the protoplasm and the nucleus are no longer visible, and which are filled by larger quantities of bacteria. Very frequently the rods in these cells appear arranged around the walls, at times rows of cells extend radially from the periphery toward the centre of the cell; finally cells are found which are tensely filled with a closely-packed mass of bacteria. Between these distended cells free hives of micrococci are sometimes seen.

Vertical sections of rhinoscleroma nodes convince us that those altered cells are quite singularly distributed in the tissue. In the deeper layers we find over larger stretches of apparently uniformly granulated round cells but a single cell or a few such filled with bacteria and greatly distended. These then form the centre of a region in which the above-described alterations can be followed step by step from the periphery, on more careful inspection. In the superficial layers the yellowish cells increase in number, and in some places we find the layers immediately beneath the epidermis or the epithelium almost exclusively composed of these distended forms. In recent or unstained

sections, these portions of the tissue bear the greatest resemblance to adipose tissue; the large round, sharply contoured cells, with their strongly refractive and, with peripheral arrangement of the rods, almost homogeneous contents, can hardly be differentiated from fat-cells. I must emphasize that this arrangement is not seen in all its details in every node aud at every part of it. These far advanced alterations are obviously found only in the oldest foci. Should we accidentally strike a node at the periphery, it may happen that in a large series of sections we find nothing but small-cell inflammatory infiltration.

Not all the round cells of rhinoscleroma tissue undergo the described alterations. A large part of them assume a spindle shape and finally changes into fibrillary connective tissue. In the spindle-cells, too, bacteria can now and then be demonstrated. These, as well as the small groups found here and there between the fibrillæ, can probably be looked upon as necrosed.

The above appearance could be demonstrated equally on nodes from the lips and ou those from the nostril or the soft palate.

As to the mode of examination, all the portions of tissue are hardened in absolute alcohol, and the sections are stained with anilin colors in the well-known manner. Methylene blue dyes the rods most intensely; gentian violet, methyl blue, fuchsin, Bismarck brown, and vesuvin likewise give good pictures. Throughout, one-per-cent aqueous solutions of the pigments were employed. Particularly distinct pictures are obtained if the sections, after being taken out of the pigment solutions, placed in distilled water and well washed therein, are transferred to a one-half-per-cent solution of potassium carbonate and left therein two or three minutes. If then they are clarified in the ordinary manner in alcohol and oil of cloves, the entire tissue becomes colorless; only the bacteria retain the pigment.

Pure cultivations of the bacteria of rhinoscleroma offer no particular difficulties. If a fresh node, the surface of which has been carefully cleansed, be incised with a sharp knife, and some of the tissue be cautiously scraped from the cut surface, we can convince ourselves, by spreading the fluid on the slide, drying and staining it, that there is present almost always a larger or smaller quantity of the characteristic rods. If a small quantity of the sap thus obtained be brought into a small moist chamber, it is possible to observe, after a few hours, under a temperature of 35–40° C. (95–104° F.), a great increase of the short rods. I could not demonstrate any lengthening into filaments or the development of persistent spores. The vegetations are visible to the unaided eye as a delicate whitish cloud. The rods show no spontaneous movements. The covering glasses were detached from the slides after twenty-four hours, thirty-six, and forty-eight hours, quickly dried over sulphuric acid, and stained. In no instance could I observe auy accidental admixture of foreigu organisms.

The bacteria increase plentifully also in blood serum and meat-water gelatin (R. Koch). Only the growth, corresponding to the lower temperature (25° C. = 77° F.), progresses more slowly.

Experimental inoculatious unfortunately have given altogether negative results. The non-receptivity of the test animals employed by me naturally does not exclude the possibility that rhinocsleroma is transmissible, perhaps by direct inoculation into the nasal mucous membrane of man or else of some other animal.

It follows from these investigations :

1. That in the tissue of rhinosclerma a certain form of bacteria is constantly present.

2. That these bacteria, furthermore, distinguish themselves by the peculiar arrangement in the tissue cells.

3. Finally, that these bacteria most probably produce the above-described regressive metamorphosis in all those cells into the protoplasm of which they have penetrated. This metamorphosis manifests itself by the disappearance of the cell nucleus, gradual enlargement of the cell with simultaneous lessening of the granulation of the protoplasm, and final change of the cellular protoplasm probably into a fluid substance. The formation of fibrillary connective tissue from that part of the round cells which have not suffered any invasion of bacteria, which takes place by the side of this regressive process, I think is a further essential characteristic of the morbid process, perhaps depending on the specific quality of the organisms. This connective tissue must be interpreted as a product of the chronic inflammatory irritation caused by these bacteria, just as the formation of connective tissue wheals around cheesy masses in tuberculosis, or the origin of many acute inflammatory forms and suppurative processes around certain necrotic patches produced by bacteria, is connected with some other kinds of schizomycetes. All observers emphasize the fact that rhinoscleroma never leads

to the disintegration of the infiltrated tissue, but rather "terminates in the formation of a firm contracting connective tissue." The nature of the process must be interpreted as a "chronic inflammation."

The exceedingly slow course of the disease, the formation of nodes in the skin, the presence of bacteria in the cells, finally the occasionally perceptible occurrence of shallow atrophic cutaneous cicatrices on places formerly the seat of nodes, in many ways reminds us of leprosy. Nevertheless careful comparison will convince us that both processes are altogether different, that the bacteria in leprous tissue play quite another part, and that the resemblance is confined merely to the presence of bacteria in the cells.

I myself have had but a single opportunity of examining a piece of rhinoscleroma for bacteria, and the result in this case was negative.[1]

## VIII. ACTINOMYCOSIS.

It is but a few years since this disease was discovered. It was Bollinger who first found peculiar bodies of light-yellow color, the size of a hemp-seed, in the partly fibrous granulation tissue inclosing many cells, of a formerly enigmatical tumor at the anterior and posterior maxilla of the ox, which had usually been termed an osteo-sarcoma. He further ascertained that these bodies were opaque acinous formations which broke down under pressure. The resulting masses again were nothing but fields of intertwined threads with club-shaped extremities radiating from the centre. Harz proposed for these formations the name actinomyces, the ray fungus; for the disease the name actinomycosis.

This disease of cattle which is to be interpreted as based on highly organized granulation tumors, has also been demonstrated in man, first by Israël, and recently by Ponfick.

Of late Johne has cast doubts on the absolute identity of actinomycosis hominis and A. bovis, because in one case he did not succeed in inoculating a calf and two pigs with the actinomyces fungi taken intra vitam from man and used quite freshly. No invasion was effected by introduction either into the abdominal cavity or into the subcutaneous tissue.

The demonstration of the infectiousness of the disease, as well as the etiological relation between the fungi and the neoplasm has been furnished chiefly by Johne. He succeeded in producing the disease by introducing free granules into the subcutaneous tissue or into the abdominal cavity. One or two months later, smaller or larger tumors arose which under the microscope exhibited the usual structure of actinomycotic growths. According to Ponfick's experiments, rabbits and dogs are not inoculable. Experiments with feeding were likewise ineffectual. But it was possible to produce typical neoplasms in the lungs by introducing the matter into the circulation.

As to the road by which the infectious material enters the body of man and animals, we shall be able to assume, with Ponfick, that any part of the external surface and the mucous membranes may serve as points of entry. Johne has called special attention to the importance of the food; he frequently found in the tonsils of healthy pigs bristly and stubble-like fibres, and beards of ears of corn which were covered with distinct actinomyces vegetations. In the case of man it is particularly hollow teeth, etc., which are to be considered as the foci of origin and development of the fungi. But in any case the fungus requires an open breach of tissue in order to proliferate into the depth of the organism.

[1] But I have seen Frisch's specimens which seemed to me to be perfectly conclusive.

Under the influence of the growing actinomyces, large tumors arise, especially in cattle, distinguished by the high degree of development reached by the granulation cells. In such tumors we find beautiful spindle-shaped elements in a copious neoplastic fibrous tissue with ample vascular development : scattered between them the acinous fungous depots of the actinomyces. No direct influence of the fungous elements on the cells seems to be present in this affection, but the fungi excite and maintain a chronic inflammation only by the continuous irritating effect of their growth.

The disease has a more immediate interest for the dermatologist on account of the fistulous tracks occurring as the result of the actinomycotic affections of the bones. Besides, doubtful affections, hitherto interpreted as "glanders," "atheromata," etc., may belong to actinomycosis. Furthermore, actinomycotic tumors must not be confounded with gummata (especially of the visceral organs) and sarcomata.

The DIAGNOSIS will be rendered certain by the discovery of the small yellow fungus granules which are even macroscopically easily visible and palpable—a diagnosis which can certainly be formed intra vitam when some fistulous tracks spring from the bone.

Aside from these practical points of view, actinomycosis is of interest for us chiefly by again furnishing the proof that the etiological factor, *i. e.*, the fungi, and not the pathoanatomical process, the granuloma formation, must form the starting-point in judging these diseases we have been here considering together. For while, in cattle, granulation tumors really characterize the disease, it occurs in man under the guise of chronic suppurative processes (especially in the face), simulating abscesses of the teeth, prevertebral phlegmons, peripleuritis with depressions and metastases, chronic pyæmia, etc. (comp. Ponfick, pp. 91 et seq.).

Furthermore, according to the point of infection, the quantity of the fungi, the mode of transportation in the organism, we see totally different clinical pictures presented. Sometimes there are firm, isolated, massively growing tumors (especially on the maxillary bones, more rarely in the lungs), sometimes countless minute patches scattered all over the lung, "in the form of an acute miliary tuberculosis," such as Pflug has described in one case. In connection with this case it should be stated that in the same stable with this cow two other animals were coughing, "and in the concrete we are certainly dealing with an ectogenous virus and a pronounced infectious disease."

As to the botanical rank of actinomyces, it is still doubtful with which species it should be incorporated (mould fungi or schizomycetes ?). The resemblance to the concretions found in the lachrymal canal which are included among the schizomycetes as Streptothrix Foersteri has induced Ponfick to consider actinomyces likewise a streptothrix-leptothrix form of a species of schizomycetes. Harz thought that its mould-fungous nature was almost certain.

In this connection I should like to make mention of the observation of a new pyrexial affection communicated by Birch-Hirschfeld which reminds us of actinomycosis. "A child was attacked by violent fever, yet nothing could be found but a loosely attached deposit on the left tonsil, of a stearin-white color, which was easily removed. After its removal the fever ceased, but ten days later the disease relapsed in the same way, and the third time after ten more days. The microscopic examination of the detached deposit, which had the form of a spherical ball almost the size of a pea, showed radially arranged bundles of mycelium the ends of which, however, exhibited no swelling, or only very slight tumefaction ; between the unjointed threads there were very numerous accumulations of closely packed, fine micrococci. After the fourth relapse had occurred, the part in question was wiped clean for ten days with a sponge and touched with powdered sulphur. No

further relapse took place. For this form of fungus, the name leptothrix fasciculatus would be most appropriate."

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Mention should here also be made of a disease endemic in India, known as the Madura foot, the etiology of which is attributed by Carter to the presence of a fungus termed Chionyphe (Carteri). An arborescent mycelium spreads in the cutaneous and subcutaneous connective tissue, leads to the formation of tubercular efflorescences, superficial and fistulous ulcerations, from the sinuous recesses of which peculiar blackish masses can be lifted up. The bones are likewise attacked and excavated. Other authors however, doubt the mycotic nature of this disease.

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Here should also be added the inflammatory infiltrations produced by the penetration of mycelium fungi into the cutaneous and subcutaneous tissue, such as kerion Celsi, certain forms of parasitic sycosis due to Trichophyton tonsurans. Under this head belong also the papillary neoplasms observed by Oscar Simon in balanoposthomycosis which resemble acuminated papillomata, but differ from them by being everywhere penetrated by anastomosing mycelia. This affection is frequently observed with diabetes mellitus.

## IX. GRANULOMA FUNGOIDES.

We now come to an ANATOMICALLY thoroughly well-known affection, but one whose ETIOLOGY has hitherto remained unexplained, and in which the character of a parasitic or an infectious disease is entirely absent. It is the disease termed by Alibert mycosis fungoides, but which we, with Auspitz, designate as granuloma fungoides.

The title chosen by Erasmus Wilson, eczema tuberculatum, most aptly represents this rare disease to those who have not seen it themselves.

There are formed flat patches the size of a finger-nail to that of the palm of the hand, sharply demarcated or with gradually fading borders; oval, round, or quite irregular; at the same level with the surrounding healthy skin or slightly elevated. The surface is of a dark red, somewhat livid color, smooth and dry, similar to urticaria, desquamating, or finally moist and soon becoming covered with yellowish-brown crusts; these (corresponding to a moist eczema) sometimes quite superficial, sometimes more deeply extending infiltrated spots are generally deprived of their epithelial covering. They do not again become covered with skin, but tumors project above the level of the skin, ranging in size from a pea to an apple. They are firm and solid, often slightly lobulated, at times with a shallow depression in the centre; often with a narrow pedicle bearing a broad overlapping body, toadstool-like. The surface is smooth and moist with an intact epidermal covering, or else excoriated and secreting a thin serous bloody fluid which may again give rise to the formation of crusts.

No regular arrangement of the lesions is recognizable. All regions of the body may be attacked.

The subjective symptoms are very variable and frequently consist in an intense itching sensation, which often appears as the only prodromal symptom.

The course of the disease is exceedingly chronic on account of the continual recurrence

of new tumors. The tumors sometimes grow rapidly, sometimes very slowly; sometimes on formerly intact skin, sometimes from long existing excoriations. After they have reached a certain size, they generally undergo spontaneous involution and often disappear without any particular pigmentation, without any cicatrix, at times quite rapidly and unexpectedly.

The implication of the general health is very variable. Aside from the trouble produced by the intense itching, sleeplessness, etc., the general condition often is not disturbed for years. Still a steadily increasing cachexia gradually ensues; all cases hitherto observed ended fatally. Only a single case observed and published by Bazin recovered in consequence of an erysipelas. The prognosis in general, therefore, is unfavorable.

Microscopic examination shows in the corium and the subcutaneous connective tissue an infiltration with typical small round cells, which are inclosed in a narrow meshwork of fine fibrillary connective tissue. In recent cases, the vessels are the first zones to be infiltrated. In the beginning, the epithelium, as in all inflammatory processes, is in active proliferation, and shows moderately widened cones. Later, it atrophies and perishes by the cellular infiltration spreading from below upward. In spite of the most careful examinations, I have been unable to find any parasites.

The disease, as has been stated, is rare. Alibert described it under the name mycosis fungoides, Tilbury Fox as fibroma fungoides, Köbner, in Paris, observed five cases as multiple papillary tumors of the skin resembling the beer fungus; Ferdinand Hebra, in 1873, reported a similar case (described by Hans Hebra in 1875, by Geber in 1878) and a second one in 1874. A more recent communication is on record by L. A. Duhring (inflammatory fungoid neoplasm). I myself know of two cases observed at the clinic in this city. Kaposi identifies this disease with the one described by him under the name sarcomatosis generalis of the skin. Finally, Auspitz and O. Simon call it granuloma fungoides. Simon thinks the tumors are to be interpreted as malignant proliferations of connective tissue in individuals who have suffered for years before from eczema or psoriasis. But the cause of these proliferations is entirely unknown.

Another view is held by the French and Italian authors. Vidal, Hillairet, Galliard, etc., Amicis, term the disease lymphadénie cutanée, and consider the cutaneous eruptions merely as the expressions of a "diathèse lymphadénique." They are led to this view not only by the histological resemblance with the lymphomata and lymphadenomata of internal organs; they report also the frequent presence of an increase in white blood-corpuscles, as well as the simultaneous occurrence of such tumors in internal organs and the skin.

Galliard gives the following resumé of his case:

1. Absence of prodromal symptoms, erythemata, etc. Immediately small indolent nodules.
2. Temporary hypertrophy of the axillary lymphatic glands.
3. Considerable enlargement of the cutaneous efflorescences in extent, not in height.
4. Rapid fatal result nine weeks after the occurrence of the first nodules. No ulceration of the nodes.
5. In the intestines, no circumscribed symptoms (as in the skin), but merely enormous diffuse infiltration of the intraglandular, intermuscular, perivascular, submucous, and subserous connective tissue.

Amicis formulates his diagnosis in the second of his cases: Dermo-lympho-adénome fongoïde, lympho-adénome splénique et ganglionnaire, avec répétition du même processus dans la foie, dans les os du crâne; Leucocythémie, pleurite exudative concomitante, marasme cardiaque.

The local treatment, according to Vidal and O. Simon, is best conducted with ointments of pyrogallic acid. No general treatment of the disease is known as yet.

## Postscript.

It was unfortunately after the printing had been concluded that I received the excellent work of Aug. Hirsch in its revised form,[1] so that I am debarred from utilizing the valuable statements of this learned investigator. This would have been especially desirable to me in the section on leprosy, because Hirsch occupies almost the opposite standpoint from the one I have taken in the most important questions, namely, those of contagiousness and heredity. Although he believes the infectious nature of leprosy to be extremely probable, he positively denies the contagiousness of the disease. He says: "According to my conviction, there is not one fact presented which speaks decidedly and incontrovertibly for the transmission of the disease by contagion." On the other hand he writes: "Only one kind of transmission of leprosy cannot be doubted—I mean the one brought about by heredity." I have felt constrained to cite these views which are opposed to my assumption, but am nevertheless inclined to adhere to my opinion. As far as I can see, two hypotheses are now opposed to one another, and of these, I must look upon the one I defend as better supported, though not proven as yet.

Especially as to the spread of leprosy on the Sandwich Islands and the doubts raised by Hirsch in reference thereto, there is no room for doubting the fact that in the decennium 1850–1860 only isolated cases occurred, but a few years later, hundreds of cases already were observed. Hillebrand has lately (by letter) called attention to the fact that possibly the forcible general vaccination succeeding the small-pox epidemic of 1872 may have contributed to diffuse leprosy in the pronounced, above-described manner. The vaccination in most instances was performed by laymen, and the supposition is not entirely without foundation that with the vaccine virus leprous germs were transferred from the sick to the well.

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Compare also in Hirsch, Sec. III., Yaws, Pian, p. 69; Sec. IV., Button Scurvy (Ireland), p. 77; Sec. V., Verruga peruviana, p. 78.

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[1] "Handbuch der historisch-geographischen Pathologie." Zweite, vollständing neue Bearbeitung. II. Abtheilung, Stuttgart, 1883.

# NEUROSES OF THE SKIN.

BY

PROF. ERNST SCHWIMMER.

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Neuroses of the skin are affections of the common integument caused by disturbed nervous activity inducing alterations in sensation, nutrition, and motility. Hebra [1] considers the cutaneous neuroses as affections in which the disturbances of innervation run their course in the skin and its nerves without demonstrable pathological alterations. Kaposi [2] expresses a similar opinion. Neumann and Bulkley have enlarged the category of those affections to some extent. Auspitz [3] has collected into three classes the group of affections due to disturbances of nervous activity; namely, diseases of innervation of the vessels, diseases of the sensory nerves, and functional anomalies of the cutaneous nerve expansions. In a recent monograph,[4] I have thoroughly discussed the dermatoneuroses, and summarized all factors which physiology and pathology permit us to adduce in favor of this view.

Since the question respecting the trophic nerves[5] is not yet decided, and as objections might be raised against basing upon it the classification of neuroses of the skin, we shall divide and attempt to discuss nervous affections of the skin according to physiologically justifiable principles, including some anomalies of nutrition which may be looked upon as tropho-neuroses.

## I. NEUROSES OF SENSIBILITY.

These consist in functional disturbances of the sensory nerves, and the qualities appertaining to them show alterations manifesting themselves as anomalies of the sensory apparatus. Diseases belonging to this class are either concomitant phenomena of other diseases, or they are separate forms distinguished by the fact that they run solely along the tracts of nerves, and are not followed by any disturbance of growth and (unless we include prurigo in this class) of nutrition. Neuroses of sensibility show disturbances either

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[1] "Handbuch der Hautkrankheiten." Stuttgart, 1876, ii., p. 540.

[2] "Pathologie und Therapie der Hautkrankheiten." Vienna, 1880, p. 704.

[3] "System der Hautkrankheiten." Vienna, 1881.

[4] "Die neuropathischen Dermatonosen." Vienna, 1883. Urban & Schwarzenberg.

[5] Ibid., pp. 37 et seq.

in the direction of increased or diminished activity, the former being known as hyperæsthesia, the latter as anæsthesia.

### 1. *Hyperæsthesia of the Skin.*

This is a condition in which there is a high degree of sensibility. When the conductivity of the nerve-tracts is intact, then, with every increased excitability of the sensory cutaneous nerves, every intensified stimulus will cause the perception of a heightening of the sensibility. Hyperæsthesia of the skin is merely a partial manifestation of a quality inherent in the entire organism; but it is not necessarily connected with the increased sensibility of all categories of sensation, for the functions of the organism may be normal, and still the common integument may be hyperæsthetic. A large number of vaso-motor disturbances can be traced back to hyperæsthesia of the skin alone, and even after intellectual irritation we see alterations in color of the skin, accompanied by sensory disturbances, such as itching, burning, and stinging.

Hyperæsthesia manifests itself by different sensations, but its essential manifestations are pain and itching. Pain is a form of excited sensibility occurring only in the diseased nerve; itching occurs with all irritations of the nerve terminations in the skin and the mucous membranes; it is a symptom of numerous skin diseases, and we shall return to it more in detail with the description of pruritus cutaneus. It differs in degree from the sensations known as paræsthesiæ, such as tickling, burning, formication, which can be brought into more or less close connection with central or peripheral affections. The stimulations affecting the cutaneous nerves and followed by hyperæsthesia are often influenced by local conditions; in some cases, the intensity of irritation will produce merely an increase of sensation, and in others not; this latter phenomenon, however, is not always characterized by sensory, but also by increased tactile sensation. Such abnormal sensations manifest themselves in numerous skin diseases; eczema, dermatitis, pruritus, etc., at times shows a so highly increased irritability of the cutaneous general and tactile sensation that the skin appears painful to the touch.

### 2. *Anæsthesia.*

Generally, anæsthesia occurs with skin diseases only when the cutaneous malady is directly connected with an affection of the nervous system, as in macular leprosy, in gangrene of she skin, etc.

Anæsthesia may be complete or incomplete and is either central or peripheral.

*a. Peripheral anæsthesia* is excited by local influences on the skin, such as abnor ma temperatures, certain caustic or narcotic substances, and finally disturbance of circulation (ischæmia). Cold and heat act equally paralyzing and anæsthetizing. In certain conditions where cold in the form of ice bags is continuously applied for days, the sensibility of the skin disappears to such an extent that pricking and pinching often are no longer perceived. On the same principles is based the local anæsthesia with the ether spray (Richardson) for operative purposes. In congelations, the affected parts are anæsthetic for some time; but if destruction of the skin occur, the anæsthesia becomes permanent. Heat acts in a similar manner: if it be very intense and destroy the layer of the cutis, the papillary body perishes completely and total anæsthesia results.

Narcotic agents, used locally, often have a soothing effect and reduce morbid hyperæsthesia; but the agent must be applied to the cutis directly, so as to act there immediately on the nerve expansions, as when blistered surfaces are covered with opiates. It is possible to secure incomplete anæsthesia by subcutaneous injections of narcotics.

Peripheral causes also include affections in which the conduction to the centre is interrupted by exostoses, exudations, tumors, or injuries of the nerves.

*b. Central anæsthesia* is always spread over larger surfaces of the skin, because its causes are situated either in the brain or spinal cord. Such conditions are produced either artificially—as after large doses of narcotics, or by inhalations of ether or chloroform, or they are due to extravasations, traumata, tumors in the central organ, or to exostoses and injuries of the bones of the skull-cap and the vertebræ.

### 3. *Paræsthesia.*

This is a disturbance of sensibility midway between the two just discussed. The paræsthesiæ are best designated as associated sensations induced by internal irritations. Among these anomalies of sensation belong those of itching, numbness, formication, burning, the velvety feeling, etc. These anomalies are not isolated sensations, and we can presuppose that, wherever hyperæsthesia and hypæsthesia exist, paræsthesia will also be found. The integument is the field for these abnormal sensations which there manifest themselves as symptoms of grave central or peripheral nervous affections, and they are usually manifestations of pruritus cutaneus.

### 4. *Neuralgia Cutis.*

In general, the term neuralgia designates that affection of the sensory nervous apparatus which is characterized by pain. Neuralgia, however, presents still other symptoms which distinguish it from other affections running along the nerve-tracts. Among these we allude to the direction in which the pain extends. Neuralgia ordinarily keeps along the track of a nerve-trunk and spreads in this direction, and it shows no uniform increase of irritation, but is distinguished by a growing and lessening of the excitement (paroxysms), between which the nerve-trunk or branch is in a normal state (intermissions); moreover, it is always provoked by internal—that is, caused within the organism—morbid processes. Neuralgia is closely related to hyperæsthesia, but is not identical with it; for both can coexist independently, and may also mutually exclude each other; the same is true in regard to neuralgia and paræsthesiæ. The latter, in case they occur with attacks of nervous pain, are present not only at the time of the neuralgic paroxysms, but also irrespective of them. As early as 1850,[1] Türck found in neuralgias that anæsthesia was more frequent than hyperæsthesia in the corresponding portions of the skin lying above the painful spot, and Nothnagel[2] states that, in the first period of neuralgic disease, hyperæsthesiæ can probably always be demonstrated, but in the later stages, anæsthesiæ. According to Nothnagel, therefore, the pain causes the changes in the cutaneous sensibility in an ascending and a descending direction.

The vaso-motor symptoms accompanying neuralgia may be either angiospasm or angioparalysis; we frequently find erythemata as sequels of neuralgia, most pronouncedly in trigeminal neuralgia; at times, eruptions of urticaria are noticed, especially in cases in which they are provoked by malaria, as in the typical hemicranias, occipital neuralgias, etc. Now and then trophic alterations in the shape of disturbances of nutrition and growth of the skin and its appendages occur after neuralgia. These are: eruptions of vesicles and bullæ (zoster and pemphigus), superficial erythemata, with inflamma-

[1] Eulenburg: "Lehrbuch der Nervenkrankheiten." Berlin, 1878, i., p. 44.

[2] Virchow's Archiv, 54 Bd.: "Schmerz und cutane Sensibilitätsstörung."

tions of the skin, actual erysipelata remaining confined to a circumscribed region corresponding to the neuralgia; moreover, anomalies in the sebaceous and perspiratory secretions, discoloration and falling of the hair, etc.

### PRURITUS CUTANEUS, ITCHING OF THE SKIN.

This forms, on the one hand, an invariable concomitant of numerous skin diseases, on the other, it is an independent affection; accordingly, we treat of pruritus in a symptomatic and an idiopathic form.

#### 1. *Pruritus Cutaneus Symptomaticus.*

Itching is a sensation which is not clearly definable in words, and which, produced by an irritation of the papillæ of the skin, yet differing from the sensations of burning, tickling, and pain, causes an irresistible inclination to scratch. The itching sensation may be produced by local or general causes.

Among the local factors are included the itching eruptions, such as eczema and prurigo, also urticaria. Some forms of psoriasis are ordinarily likewise accompanied by itching, still the eruption is often very extensive without causing any itching. The cutaneous affections due to animal parasites, acarus scabiei, bugs, fleas, as well as some others caused by vegetable parasites, such as herpes tonsurans, eczema marginatum, are always accompanied by violent itching, while pityriasis versicolor never, or only exceptionally causes any itching. In the cicatrization of ulcers, during the formation of granulations, an intense itching, too, frequently appears. Again, itching occurs as a symptom of certain general morbid conditions; for instance, some hepatic diseases connected with icterus; furthermore, in exanthematous fevers, such as scarlatina and measles, both with the appearance of the exanthem and in the stage of desquamation; on the other hand, in certain dyscrasic conditions such as syphilis and scrofulous affections, pruritus is usually entirely absent.

The internal processes during itching are difficult to trace. The facts that some acute exanthemata as well as icterus cause itching, that intense pruritus is at times found in medicinal erythemata, leave it to be inferred that, under some conditions, a noxious element gets into the blood and excites the nerve termini in the papillæ. In other cases, however, we must consider this hyperæsthetic state as a local process independent of some influence on the blood. Such a process would be, perhaps, the stasis of the blood in the papillary body which is usually found in exudative conditions. The increased plethora within the efflorescences produces pressure on the nerve termini which is felt as an itching sensation, and the pruritus persists as long as the stasis; but whenever the morbid exudation diminishes with the defervescence of the affection or by the removal of some vesicles or nodules by the scratching consequent on the violent irritation, the itching will now and then decrease.

It is self-evident that, in the case of the parasitic affections of the skin, some less remote factors for the explanation of the itching can be found.

#### *b. Pruritus Cutaneus Idiopathicus s. Prurigo sine Papulis.*

This affection was in former times often mistaken for prurigo. In this connection we will only point out that, although both forms of disease resemble each other closely with reference to the nervous accidents, they still are not identical processes; the chief difference being, that in pruritus the itching present is general or exists on circumscribed spots without a papular eruption, while prurigo shows an itching nodular eruption.

Pruritus cutaneus has also been termed pruritus formicans and senilis (Willan), or prurigo latens (Alibert), partly because the itching provokes a sensation resembling the crawling of ants, partly also because this nervous condition is very frequently observed in old people. With respect to the symptoms in pruritus we must point out that in every long-standing similar affection excoriations in variable number and extent occur, owing to the continuous violent irritation, in consequence of the scratching, and the original morbid picture is then easily overlooked. It is important, therefore, to distinguish the excoriated nodules in prurigo from the excoriated epidermis in pruritus, and the various alterations occurring in the two forms of disease will be readily and distinctly perceptible.

The distinction between pruritus universalis and pruritus localis is perfectly justifiable practically.

*Pruritus universalis* generally occurs by extensive portions of the skin or even the entire surface becoming attacked by violent itching. This condition may appear both in old and in young individuals, can often be brought into close causal connection with disturbances in the abdominal functions, with affections of the liver and kidneys, especially with cirrhosis of the liver, hepatitis, and Bright's disease, and may frequently be observed in young girls subject to menstrual anomalies, as well as in pregnant women as a consequence of gravidity. Pruritus universalis, however, is most frequently found in advanced age, where it forms a most annoying condition, because the nervous symptoms usually persist for a long time and can be made to disappear but very slowly. Wherever internal causes exist, the itching will call attention to the fundamental affection, and in this respect pruritus universalis possesses some diagnostic importance.

*Pruritus localis* shows great preference for certain parts of the body, and pruritus of the sexual apparatus especially is associated with the most troublesome incidents.

In accordance with the localities we distinguish:

*a. Pruritus ani.*—In adults it is often a concomitant of hemorrhoidal affections and in children a symptom of intestinal worms which is rarely absent. The disease usually extends from the anal mucous membrane to the perineum and backward as far as the coccyx. The itching is generally more intense at night, in consequence of the heat of the bed; the patients cannot abstain from scratching, and artificial eczema is frequently produced in this manner.

*b. Puritus genitalium.*—In men the scrotum is the usual seat of the affection, but almost always in connection with pruritus ani. The skin of the scrotum presents no pathological alteration in the beginning of the affection, only after prolonged existence we find excoriations, or slight serous exudations on the affected skin as sequels of the artificial eczema which is of later origin. Scrotal pruritus is generally remarkably intractable. I have observed patients in whom the attacks of itching and simultaneous pain were of such intensity that the patients acted as if demented.

*Pruritus pudendi muliebris* is encountered most frequently at the transition of the vaginal mucous membrane into the labia minora or majora, or else it is limited to the clitoris and the labia minora. In children it should never be neglected to examine for ascarides which are in the habit of migrating from the anus into the vagina; in women, diseases of the uterus, leucorrhœa, vaginismus, etc., are often the cause of the affection; frequently, however, these phenomena are entirely absent, and the itching appears simply as an idiopathic neurosis. In young girls the violent hyperæsthesiæ may lead to the disagreeable complications of onanism and nymphomania, and even women in the climacteric age are not exempt from this evil. Devergie was one of the first to observe pru-

ritus in connection with diabetes mellitus and claims to have cured both maladies by arsenic. I, too, have repeatedly seen diabetes and Bright's disease conjoined with general and local pruritus, but I was unable to note any effect from the use of arsenic.

Local pruritus, besides, occurs as pruritus of the palms of the hands and the soles of the feet, with on the whole moderate symptoms which ordinarily are not persistent and by no means lead to complications similar to those just mentioned. Several years ago, Duhring called attention to a peculiar form of pruritus—pruritus hiemalis,[1] occurring in some individuals usually about winter time. The itching ordinarily begins at the extremities and then spreads over larger parts of the body. I myself know several persons who for years have been in the habit of presenting themselves about winter time with their cutaneous itching and its consecutive complications, such as excoriations and eczema, and in whom we must think of some neuropathic factor caused by cold, judging from the recurrence of the affection at a certain season and its abatement with milder weather.

*The Diagnosis*

of pruritus offers no difficulties when all factors are closely observed. In the first place, the subjective sensations are to be noticed. In the beginning of the affection the patients complain of continuous and troublesome itching, and inspection of the skin shows no alteration. But when the neurosis persists for days or weeks; and the patients, forced by the itching, begin to "belabor" their skin energetically, then in the daytime, excoriations, wheals, thin crusts, and stripes are observed as the result of scratching at night. In the case of a skin affected with pruritus, therefore, the question always suggests itself whether we have to deal with a commencing or a long-standing disease; in the former case, the objective symptoms are still slight, in the latter already very numerous. In dealing with an affection characterized by intense itching, when the skin presents a whole series of alterations, we have only to consider the differential diagnosis. In eczema we always have to bear in mind inflammatory changes or in its modifications such alterations as point to an exudative process—weeping, red, scaly, crusty, or infiltrated surfaces; in scabies and prurigo, changes determined by a certain fundamental affection; in the former, the burrows of the parasite, the formation of pustules and nodules, as well as often a definite locality of the malady; in the latter, alterations to be considered more in detail in the description of this disease. Chronic urticaria, owing to the temporary appearance of itching, probably offers greater difficulties than the above-named affections; but the intense effects of scratching are usually absent, and the statements of the patients or the inspection of the skin at definite times—namely, when the exanthem is in the habit of appearing—together with the observation of the wheals, render the diagnosis positive. Pemphigus pruriginosis will not fail to show the presence of bullous efflorescences which are absent in pruritus.

Furthermore, in many cases it will be important to bear in mind the fundamental affection, Bright's disease, diabetes, senile metamorphosis, local diseases such as those of the hemorrhoidal vessels, etc., in order to accurately estimate a local or general pruritus.

*Treatment.*

In all cutaneous diseases producing itching, such as eczema, puritus, psoriasis, pityriasis rubra, urticaria, this troublesome symptom will disappear with the causative disease, if the treatment appropriate to that affection is employed. Much more

[1] "An Undescribed Form of Pruritus." The Amer. Journ. of Dermatol. New York, 1874, p. 193.

readily than in these diseases is the itching overcome in the parasitical cutaneous affections—scabies, herpes tonsurans, favus, etc.—by the destruction of the animal or vegetable parasites. But where the pruritus does not depend upon other affections of the skin, endeavors should always be made to relieve other morbid conditions. In disease of the stomach and liver, the alkaline saline springs are generally followed by very favorable results. In anomalies of menstruation or chlorosis, iron and bitter tonics are indicated, their choice and application depending on the degree of the malady. But despite all internal medication, the local treatment must never be kept out of sight; it acts directly soothing, and is more effective than the most diverse narcotic agents, such as opium and its alkaloids, potassium bromide, chloral, hyoscyamus, etc.

The chief feature of local treatment in general pruritus is the use of cold ablutions and douches. Swimming and full baths, in the summer season, may be taken in the river, at other seasons in the various indifferent thermal institutions, or at home in bath-tubs. While cold water is used twice daily in the form of rapid ablutions (not in the form of a cold-water cure which is injurious in pruritus), the baths may be taken daily, either pure or with the addition of sodium carbonate, one-half to one kilo for each bath, in which the patients remain for half an hour or more at a temperature of from 20–24° C. Steam baths, once or twice per week, have also a favorable effect.

The various preparations of tar often prove effective as inunctions in the form of ointments and solutions. The empyreumatic oils may be used with considerable effect, namely: Ol. rusci, cadini, fagi, and carbolic acid in one or two per cent solution, naphthol in three to five per cent solution. For instance: ℞ Ol. cadini, 10; Glycerini, 20; Alcoh. rectif., 150; Spts. lavand., gtt. xx. M. S. Externally. Or, ℞ Acidi carbolici, 3; Æther. sulph., 2; Alcoh. rect., 150; Aq. dest., 50. Or, ℞ Naphtholi puri, 4; Ung. emollientis, 80; Bals. Peruviani, 2.5.

When tar and its derivatives fail completely, as is unfortunately sometimes the case with pruritus, especially the senile form, or whenever it loses its efficacy after a certain time, I have often seen satisfactory results from sulphur ointments—Lac. sulphur., 5 grams; Ung. simplic., 40 grams, with or without tar. Corrosive sublimate also proves of use sometimes, both in the form of lotions and as an addition to baths, perhaps according to the following formula: ℞ Hydrarg. bichlor. corr., 3 grams; Mur. ammon. depurati, 10 grams; Aq. font. dest., 80 grams. M. S. To be applied to one full bath.

Frictions with alcoholic liquids, in conjunction with chloroform, cologne water, and ether, may also be tried, but they help only palliatively, and not invariably. Chloral in the form of ointment (5:40), recommended by some French physicians, has often failed in my hands. In local pruritus, according to its seat, the same treatment as in general pruritus may be used. In pruritus scroti and pudendi, with the tar inunctions, diachylon ointment may be applied through the day and even by night with temporary amelioration of the paroxysms of pain; but in these generally inveterate forms the remedies require to be changed frequently, many having but a passing effect. In all forms of pruritus pudendalis, cleanliness is the first requisite in treatment; the ointments must always be prepared with pure and fresh fat, and the solutions must not be too strong. The drugs to be recommended are carbolic (1 to 2 per cent) and boracic acids; for instance, ℞ Acidi boracici, 2.5 grams; solve in aq. ferv. Acid. salicylici, 4 grams; Alcohol. rectif., 50 grams; Aq. dest., 100 grams. M. S. Lotion. Or, ℞ Acid. borac., 5 grams; Glycerin., 20 grams; Spts. vini, 100 grams. M. S. Externally. The sublimate lotions recommended by Trousseau (0.08–0.1 : 200 of water) are often useful; painting with solution of silver nitrate, or even touching with the solid stick, should be

tried only in certain cases, because in pruritus vulvæ especially, owing to ready irritability of the vaginal mucous membrane, disagreeable inflammatory conditions may ensue. Hydrated alumina has sometimes done me good service in the following formula: ℞ Alumin. hydrat., 5 grams; Glycerini, Ol. olivar., āā 20 grams; Ung. moll., 40 grams. M. S. Ointment. Local douches and ablutions with tepid or cold water, vapor baths with decoction of hyoscyamus, suppositories of belladonna or opium are of but temporary benefit, yet can rarely be dispensed with, the affection being so stubborn as to frequently try the patience of the physician and his client severely. Thymol, 1; Glycerin, Alcohol, āā 20; water, 600–800, in combination with many of the above-mentioned remedies, often proved useful in my hands. In hystero-nervous subjects, potassium bromide, atropine, and arsenic may be given internally. The main thing is perseverence and patience on the part of the sufferer and the physician.

## II. VASO-MOTOR SENSORY NEUROSES.

This class comprises a series of affections in which the disturbance of sensibility is less than in the above-mentioned diseases, but in which the influence and participation of the vaso-motor nerves produce pathological conditions on the common integument which are associated with fluxionary or inflammatory processes. We have stated in connection with the hyperæmias that all pathological alterations caused through the innervation of the blood-vessels are to be designated vaso-motor or angioneurotic affections, and in the same place we have discussed erythema hyperæmicum and roseola congestiva as cognate forms. We shall discuss here only those affections which cause prolonged alterations and are characterized, besides the fluxionary disturbances, by nutritive morbid processes. These latter manifest themselves by metamorphoses of tissue and simultaneous vascular disease. Erythema hyperæmicum, as an angioneurosis, by itself forms a clinical morbid picture in the same way as the polymorphous erythemata now to be considered.

Between these conditions, often representing merely transitional forms, there are certain affections which cannot very well be accepted as diseases of the skin, but only as the alterations projected on the common integument by the pathologically changed vessels; they are: angiospasm and angioparalysis which, under certain conditions, are followed by erythemata and even extravasations on the skin.

The pattern of the forms of disease to be discussed here is erythema multiforme; the other erythemata and the urticaria related to it form its natural sequence.

### 1. *Erythema Multiforme.*

*Definition and Symptomatology.*—Hebra has distinguished a series of erythemata, which he designated as caused by congestion, from the analogous slower forms which he considered as due to exudation; and, therefore, he called the latter, on account of the manifold character of the pathological form, exudative multiform erythemata. Hence, since the time of Hebra, the exudation formed the criterion for classing erythemata.

The generally short duration of the disease and the insignificance of the subjective symptoms have directed the attention of numerous physicians rather to the size and extent of the visible exudation than to the deeper nature of the malady; but careful observation and further experience have led us to take cognizance also of the concomitant and subsequent phenomena. The first to attract attention was the fact that erythema

does not always appear as a simple dermatonosis, but is often connected with fever and rheumatic pains, and stands in manifold relation to inflammatory conditions of the joints, as well as of the heart and pericardium ; again, some observers found that this cutaneous disease at times is dependent upon disturbances of the nervous system.

In view of this twofold clinical character, it would be logical to change the term applied to this disease for each of these forms, especially that progressing with fever, and for this reason Lewin[1] has proposed to call the former "dermatitis exudativa." The same author has fully accepted the view previously expressed by Köbner[2] and Auspitz[3] that erythema is to be interpreted as an angioneurosis.

The opinion that erythema is a pyrexial affection analogous to the exanthematic conditions, has not been completely proven even by Lewin ; for were we to designate the various stages of erythema as prodromal, eruptive, and desquamative—analogous to those occurring in variola or scarlatina—were we even to admit the infectious nature of the agent producing erythema, still the dissimilarity of the symptoms in the course of this disease is so marked that it cannot be brought in analogy with the typical and cyclical course of the other acute exanthemata, and the contagiousness which exists undisputed in the former cannot be demonstrated as a cause of erythema.

Therefore, if we consider erythema multiforme as the product of an affection appearing with various efflorescences, the basis of which is the patchy redness, the erythema, it is easily understood that Auspitz,[4] taking the redness as the starting-point of the pathological process, endeavored to group together all those diseases developing on this basis, at the same time giving this fundamental form the name erythanthema, *i. e.*, formation of efflorescence with an erythematous fundamental lesion. Among these erythanthemata Auspitz included all kinds of erythema, herpes and its varieties, peliosis rheumatica, certain unclassified forms of eczema, with some vesicular eruptions (!). Less correct nosographically, such a widening of the term would produce a separation of some types of disease which we at present are not yet able to disconnect from the patho-etiological conception. We, therefore, choose the older term, multiform erythema, but with this difference, that we eliminate the qualifying adjective exudative, in view of the pathogenetic condition, and prefer to speak of an angioneurotic and trophoneurotic erythema.

By erythema multiforme we understand a skin disease running an acute or subacute course, characterized by the formation of patches of a vivid red or dark color which are variously joined together ; their size ranges from that of a millet or hemp seed to that of a lentil ; they temporarily pale under pressure of the finger ; they are often transformed into other efflorescences, and may occur on all or only on isolated parts of the body (dorsum of hand and foot). The patchy form constitutes the starting-point of the erythema. The circumscribed hyperæmia of the skin with which the affection begins lasts but a short time, becomes gradually more intense ; the skin, originally flat and smooth, becomes somewhat firm, slightly swollen, and by infiltration and increase of tissue within the several efflorescences the alteration is effected, during which are formed both nodules the size of a hemp-seed and nodes (erythema papulatum et tuberculatum) and larger discolorations from the size of a thumb-nail to that of the open hand. The extension and metamorphosis of the original erythematous patches proceed irregularly; at the borders of the old spots new efflorescences often arise which, being of the same

[1] Charité-Annalen, iii. Bd., 1878, p. 622.

[2] "Klinische und experimentelle Mittheilungen." 1864.

[3] "Ueber venöse Stauung." Arch. f. Derm., 1874, p. 310 et seq.

[4] L.c., p. 72.

character as the former, maintain the picture of the erythema, the coloration alone showing some difference, the recent efflorescences being always more vivid than the older ones which, gradually paling, resume the normal color of the skin. This variable behavior influences the grouping of the several efflorescences. Thus the form in which the efflorescences spread peripherally and resolve at the centre is called erythema annulare s. circinatum; when new efflorescences continue to develop from the circular lines in greater dimensions which run in wave lines, circumvoluted, it is erythema gyratum; if the several nodules change into stronger infiltrations and new efflorescences resembling urticaria appear near them in numerous places, we see erythema urticatum. Transitional forms from one species of efflorescences into another may likewise be observed, namely when vesicles and bullæ develop from the nodules; then it often appears questionable whether this affection, presenting itself as erythema vesiculosum and bullosum, does not approach nearer to herpes than the erythemata (comp. below: erythema iris).

The localization of erythema multiforme forms an important symptom; its occurrence on the dorsum of the hand and foot was believed to be the most constant phenomenon. More exact observation, however, showed that erythema may occur on any part of the body, with or without simultaneous affection of the dorsum of the hand and foot; some observers even found intense eruptions of erythema in which these portions of the skin remained quite intact. The preponderating frequency of the occurrence of eruptions along the extremities was specially determined by Lewin, and he ascertained that the places of predilection of the erythemata were those where flat tubular bones are covered with thin muscular strata and tendon sheaths, *i. e.*, the extremities, the skin of the forehead, etc. This statement hardly furnishes any explanation of the nature of the erythemata, for we meet with erythema on the cheeks, the nates, the abdomen, also on the mucous membrane of the cheek, the pharynx, and the genitals (Lipp,[1] Behrend,[2] and others).

The *duration* of erythema multiforme is very variable. The nodular eruption is usually of very brief duration, and involution generally follows rapidly; while the nodular form represents a more chronic type, merely on account of the greater extent of the affection. I should not like to assert that abscess formation and ulcerations really occur, and it seems to me that all the similar statements (Hardy, Purdon, Breda, Oehme) refer rather to erythema nodosum. The ordinary average duration of erythema varies between several days and one or two weeks; only the intense and extensive forms are prolonged beyond this time, as are those where fresh exacerbations ever recur anew; but even the most intense form generally disappears within six or eight weeks without leaving any sequelæ. Where there is a tendency to relapses, the duration of the disease is unlimited, and it is a peculiar fact that erythema multiforme, in relapsing, generally reappears on the places first attacked. Unfavorable terminations occur only when complicating accidents influence it. It may not rarely be observed that extravasations are liable to occur in the nodules; when coexisting with articular affections, they have often been considered forms of purpura (Bohn, Legrand, Purdon), but this connection with rheumatic accidents is not essential, and the extravasation may be looked upon as an alteration directly belonging to the angioneurosis.

The *complications* of erythema are very manifold. The local conditions are rarely of importance—slight itching, pricking of the skin appears with the eruption; the symptoms are different, however, when the erythema is conjoined with high fever, with disease

[1] Arch. f. Dermatologie und Syphilis, 1871, p. 222.

[2] Ibid., 1877, p. 363.

of the serous membranes, articular pains, hemorrhages, etc. Formerly, such complications were not accepted as belonging to the symptoms of erythema; but at the present day there is hardly any doubt that all these phenomena are connected with the polymorphous erythema; and just as the acute exanthemata now and then have erythematous percursors, so other general diseases of an infectious or toxic nature may be conjoined with erythema. The agent causing pleuritis, endocarditis, meningitis, etc., may also give rise to the erythematous angioneuroses. I have observed numerous complications of this class, and think that the erythema must not be separated from the fundamental or accompanying affection. At times erythema multiforme runs its course without being localized in the internal organs; but we have stated above that it is inadmissible to consider it an affection analogous to an acute exanthem (Lewin); the most correct explanation will always be to designate such cases as idiopathic febrile affections; in many cases we are quite unable to determine to what extent they represent a symptom of certain noxious matters which have entered the system.

The *diagnosis* rests on the above-described alterations of the skin which at first appear as spots and after a brief existence as nodules and nodes causing neither much itching nor the formation of scales. The short duration of the cutaneous affection, its spread into the neighborhood, generally without at the same time occupying larger surfaces, facilitate the recognition of the disease. In very many cases, the occurrence of the efflorescences on certain parts of the body, such as the dorsum of the hand and foot, helps to determine the diagnosis. The violent subjective symptoms of itching; the transition into vesicles, scabs and crusts; the uniform, more extensive infiltration in the corium and the underlying layers of tissue, will serve to differentiate it from eczema. Prurigo is an affection of early life which is preceded by urticarial wheals, but not by grouped nodules; which, besides its intense itching, runs a chronic course and evinces a preference for the extensor surfaces of the extremities. The micropapular syphilide never occurs so acutely that it could be seen to arise and disappear in the time appropriate to the erythemata; besides, it is accompanied by other complications. Careful observation and thorough examination of the case will prevent its being mistaken for variola—an error which has been mentioned by Lewin, Behrend, and Résillaud.

Before entering on the further discussion of the multiform erythemata, we shall enumerate the following closely related special forms, namely:

### 2. *Erythema Iris et Circinatum, and Herpes Iris et Circinatus.*

Erythema iris really represents a variety of erythema multiforme, inasmuch as it is determined merely by the configuration of the efflorescences; but as this erythema almost constantly leads to the vesicular form, and inversely the latter can be brought into full analogy with the erythema, the independence of this form is justified pathologically.

The points which this affection has in common with and which distinguish it from the species of erythema above mentioned and those of herpes to be discussed below are the following:

*a.* The occurrence on parts of the body where erythemata appear very frequently, but herpes very rarely, namely the dorsum of the hand and foot.

*b.* The coexistence and transition of erythema iris and circinatus into herpes iris and circinatus.

*c.* The occurrence of these herpetic forms as well as of the erythema at the same time of the year—in the spring and autumn months.

Respecting the peculiarity of the iris form we wish to add the following:

Erythema iris owes its name to the spots, as does herpes iris to the vesicles, which develop in a certain grouping; peripheral, circularly arranged efflorescences forming around one centrally located. The number of the circles thus formed is variable. The term iris was used by the first observers (Willan-Bateman) on account of the various tints of colors; various shades of white and red are present, according as the patches or vesicles appear tinged by the more or less intense congestion or exudation. The normal skin between the patches and circles of vesicles always forms the lighter coloration, the affected parts being darker.

The duration of the exanthem depends on its intensity and extent; while some, usually the central efflorescences, dry, others fill with serous fluid, but the whole process lasts at most ten or twelve days and ends in complete recovery. In some cases the vesicles enlarge by the confluence of isolated efflorescences; this is, as it were, the most extreme degree of development of erythema iris, which may change into herpes and finally into pemphigus iris.

*Erythema and herpes circinatus* are modifications developed from the iris form as when circles of vesicles develop without central efflorescence, but they may at times be observed as primary affections in no causal connection with herpes iris. In this case we find series of red spots circularly arranged, from which are developed, in a short time, vesicles whose further course is in no way distinguished from herpes iris.

Strange to say, a disease due to parasites has by some dermatologists likewise been designated herpes circinatus (identical with herpes tonsurans). This view is erroneous; still there are at times parasitic affections on the dorsum of the hand which have every appearance of an erythema circinatum. Kaposi mentions some cases in which the suspicion of the presence of fungi was verified on microscopic examination; in the same way we occasionally find on the skin of the arm and the trunk similar diseases presenting the appearance of the erythemata which bear quite insignificant scales and likewise show a parasitic condition. But we must not be led astray by isolated misleading observations, for the erythemata here discussed are never of a parasitic nature; otherwise the diagnosis of these erythemata is based on the factors enumerated under erythema multiforme, and is materially facilitated by the configuration of the efflorescences.

Herpes iris with its related forms is usually a non-pyrexial affection, but sometimes it assumes a grave type, like the multiform erythemata, in which case the skin affection plays a prominent part; Wunderlich,[1] Gerhardt,[2] and others have reported instances in which multiple erythemata appeared on the body with every indication of a grave typhoid affection together with high fever; the eruption subsequently changed into vesicles and presented the picture of herpes universalis. On the whole, such observations are rare; but while they prove the transition of erythema into varieties of herpes with grave general complications, they fall under the same head as the pyrexial erythemata in general, of which we have spoken above.

### PATHOGENESIS OF THE POLYMORPHOUS ERYTHEMATA.

The exciting causes of the erythemata are to be separated from causes of disease in so far as the latter give the incentive to those influences which change the vascular activity and thus lead to temporary or prolonged alterations. The pathological alteration of the blood-vessels concerns either the vessels alone or the tissues in which they ramify, and accordingly we may assume different disturbances caused thereby. Temporary alterations

[1] "Remittirendes Fieber mit Phlyktäniden-Eruption," in Arch. d. Heilkunde, 1864.

[2] Under the same title in Wien. med. Wochenschrift, 1878, Nos. 28–30.

of the vessels are characterized by the changed state of the blood pressure, by the fluctuations in temperature, and by the coloration of those parts of the skin which lie in the domain of the diseased vascular territory; they are comparatively of short duration, and subside without leaving any further changes; we have discussed them already with the hyperæmias as pure angioneuroses. It is different with the persistent alterations provoked by essential disturbances within a certain territory of the circulation, whereby nutritive changes follow incidentally. These metamorphoses form the manifold efflorescences such as we have described above as the forms of the polymorphous erythemata, and which may therefore also be called trophoneurotic diseases. The neurotic nature of all forms of erythema can be demonstrated by clinical and pathological experience, and we may designate as pathogenetic factors both peripheral and central irritations acting on the nerves without actual disease of the latter. Often in locomotor ataxia, in conjunction with the lightning-like pains, rapidly disappearing erythemata or attacks of urticaria may ensue which, if of longer duration, may induce other cutaneous affections.

Charcot[1] has called attention to the fact that at times within a few hours and often several days after the onset of disease of the brain and spinal cord erythemata of irregular extent and uniform duration show themselves on various parts of the skin. They are likewise to be considered the initial stages of further alterations on the common integument, such as blebs or vesicles, which again may be transformed into ulcerous forms (gangrene of the skin). Although the question as to the pathogenesis of the erythemata and many analogous exanthems is not completely solved, it is sufficiently elucidated to serve in explanation of numerous obscure points.

As regards the special causes producing the erythemata, we must admit that they are in many directions very imperfectly known. It is certain that the erythemata usually occur with greater frequency in the spring and autumn months—that is, the time when erysipelas and urticaria are most common. This morbid tendency is produced, besides the telluric, by many known and unknown influences, and we can define some types of erythema as pathogenetic forms; but here it is of minor importance whether the kind of efflorescence manifests itself as node, nodule, vesicles, or superficially, in circles or wave lines. Among the erythemata belonging under this head we enumerate:

*a.* The erythemata in consequence of disturbances of digestion. The status gastricus, with temporary anorexia and impaired digestion in children and adults is often followed by an erythema of brief duration, generally on the surface of the thorax and the upper extremities. Infants suffering from dentition or otherwise are also likely to be attacked by erythema in the form of large confluent patches, or isolated spots from a hemp-seed to a lentil in size, spreading over the surfaces of the back and thorax—erythema infantile, roseola infantilis. For these erythemata, the view was long accepted that the nervous system caused the reflex conditions on the skin by being put into increased activity through the morbid excitation exercised by the mucous tract.

*b. Medicinal Erythemata.*—They are reflex affections due to the entrance into the organism of drugs, whether by the stomach, subcutaneously, or per enema. These erythemata are merely a variety of the manifold exanthemata due to drugs. The attention of physicians has been directed to this subject only of late years. Behrend,[2] Morrow,[3] Van

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[1] "Leçons sur les maladies du système nerveux faites à la Salpétrière." Paris, 1880, I., p. 84.

[2] Berliner klin. Wochenschrift, 1877–79.

[3] New York Medical Journal, March, 1880.

Harlingen,[1] Hutchinson,[2] and others, have published numerous communications on these forms of erythema in particular, while other authors have written more about the papulous, bullous, and hemorrhagic forms. Of the drugs which have been followed by erythematous eruptions should be mentioned: opium and its preparations, belladonna, quinine, salicylic acid, arsenic, chloral hydrate, calomel, and at times phenol. In some cases, the eruption appears like scarlatina, in others again in a circumscribed, patchy form; at times, an urticaria-like exanthem develops. It is strange, though, that the drug erythema, whether appearing in superficial form (rash), or as nodules, affects different portions of the skin, according to the drug administered; sometimes only the trunk and abdomen, sometimes the lower and the upper extremities are involved, but rarely the erythema seems to cover the whole body, and it is just this isolated occurrence which leads to the conclusion that the action of drugs, which is peculiar not to a single remedy, but to an entire series of them, is to be looked upon as but a physiological effect, the vaso-motor nerve-centres suffering a change as in the acute exanthemata.

*c.* The *Fever Erythema.*—We comprise under this term the erythemata occurring with the febrile process in general, and with forms of eruption connected with it. Even in temporary pyrexial states, a fugitive redness is apt to occur on some parts of the body with the onset of the hot stage, and this appears as a permanent symptom in a series of feverish eruptions in which it occurs as the prodromal erythema. The most important form belonging here is erythema variolosum s. roseola variolosa, a diffuse dark redness occurring in the shape of reddish spots of brief duration on the skin of the abdomen, as well as on the inner side of the thighs, which is to be regarded as the first beginning of the variolar affection. This erythema, at times, spares the genitals, while the axillary region, together with the adjoining portions of the arms, is more frequently attacked by circumscribed erythema. Very frequently there is also an extensive hyperæmia, like a scarlatinoid disease, over the entire integument, often sparing only the head and neck, often merely the abdomen, while in other cases the erythema attacks only the skin of the extremities, especially around the joints, as well as that of the hands and feet. Nosologically, this prodromal erythema is a vaso-motor sensory neurosis.

Erythema variolosum has often been mistaken for another pyrexial skin disease, and many observers have held to the belief in the simultaneous co-existence of two acute exanthemata. Hebra had positively denied the possibility "that two essentially different acute exanthemata could at the same time occur in one individual." Pædiatricians disputed this assumption, and there is hardly any doubt that such coexistence may happen. For a number of years I have had the opportunity to see numerous cases of this kind. A probable explanation for the simultaneous coexistence of two acute exanthemata might be furnished by the parasitic causes of disease, inasmuch as the micrococci and the bacteria found in acute exanthemata do not exclude the possibility of a two-fold disease within the organism. Characteristic for these combined exanthemata is the simultaneous demonstration of the definite efflorescences of each of the exanthems (such as the macular for morbilli, the diffusely punctate for scarlatina, and the vesicular and pustular for variola) and the manner of disease of the affected mucous tract, as it otherwise manifests itself in the various exanthemata. The difficulty in diagnosing these mixed forms lies, perhaps, for some physicians, in the defective recognition of these rare pathological conditions, for in the older records we may find descriptions of diseases which were called peculiar species, as, for instance, a scarlatina vesiculosa, pustulosa, pemphigoidea, etc., or perhaps, a variety of morbilli which, lasting but a short time, recurred after a few days with renewed signs of fever and showed a changed character of the efflorescences.

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[1] "Medical Eruptions," Arch. of Dermatology, 1880, p. 337.

[2] St. Bartholomew's Hospital Reports, 1878.

In connection with the erythema of variola it remains for us to mention the erythemata of vaccinia, as well as those which now and then occur as precursors of morbilli and scarlatina, also the erythema in prolonged pyrexial processes which represents a concomitant eruption of the primary disease, as in typhoid fever and at times in cholera—roseola typhosa and choleraica. The erythema or the roseola in typhoid fever is brought about in consequence of an inflammatory process and appears generally in the middle or toward the end of the first week of sickness, is of pale-red color, the size of a hemp-seed to that of a lentil, covers chiefly the thorax and the extremities, and, in grave cases, is easily transformed into ecchymotic types. In cholera the erythema occurs only toward the end of the violent symptoms, continues for a very brief time, and disappears as soon as the general condition moderates. The cholera erythema exhibits larger spots than those appearing in typhoid, is more livid and dark in color ; Hebra observed it in the epidemic of 1866 at Vienna, and noticed that it occurred only sporadically in about one per cent of those attacked.

Among the erythemata of grave pyrexial diseases mention should also be made of the forms occurring in the course of diphtheria. According to my experience, they always appear as papular exanthems mostly covering the trunk, last from four to six days, until they fade with slight desquamation. In affections of the genitals, especially blennorrhagic conditions, erythemata also occur as reflex phenomena.

### *The Prognosis*

of the erythemata in general is not unfavorable. The efflorescences usually diaappear after a brief existence without any further alteration of the skin ; should the efflorescences continue longer, they ordinarily leave bluish pigment spots which are likewise lost in the course of time. A less favorable prognosis is presented by the grave pyrexial erythemata with complicating diseases of the mucous and serous membranes. Experience shows that the erythemata connected with erythematous nodes on the mucous membranes run a graver course and at times end fatally. Hebra makes mention of such a case in which the autopsy showed infiltrations on the mucous membrane of the intestinal tract which he connected with the cutaneous erythema. Grigorow[1] not long ago described a case of erythema attacking the skin and the mucous membranes which led to ulcerations in the mouth and finally ended fatally. The cases termed "ominous" by Uffelmann[2] are merely more intense nodose eruptions of erythema occurring in ill-nourished children with constitutional disease.

### *The Treatment*

of the polymorphous erythemata is purely expectant. Many therapeutic experiments have taught us that it is only in a small series of cases we can secure prompt remedial effects. Ergotin, in the dose of 1 to 1.5 grams per day, has in a few cases brought about a more speedy involution : I found it of use where the erythema repeatedly recurred and showed a strong tendency to persist. Where the erythema can be traced to a pathological factor, the reflex affection is mastered more readily with the removal of this factor.

Where the erythemata are connected with moderate itching, we may employ cold ablutions; in other cases, mere dusting with starch, pure or mixed with zinc (Zinci oxidi,

[1] Vierteljahrsschrift f. Dermatologie, 1880, p. 109.

[2] Deutsches Arch. f. klin. Med., xiv., 1876.

2.5 grams; Amyli, 50 grams); or sulphurated zinc ointment (Zinci oxidi, Lactis sulph., āā 2 grams; Ung. emoll., 30 grams). Alcoholic frictions with salicylic or carbolic acid (2 to 3 grams of the former, 1 to 1.5 grams of the latter in 100 grams of alcohol) often are quite serviceable; should they be found to irritate the skin, their use must be interrupted. Erythemata connected with rheumatic conditions require no independent treatment; the attention must be chiefly directed to the primary affection.

### 3. *Erythema Nodosum.*

Somewhat akin to the polymorphous erythema, but not to be identified with it in a clinical sense, is erythema nodosum.

It appears in the shape of nodes and excrescences the size of a pea up to oval and hemispherical tumors as large as the palm of the hand, chiefly occurring on the extremities, seldom isolated, but nearly always in larger numbers. In the beginning, they are dark-red, hot, and painful on strong pressure; subsequently, they change their color, become bluish-red, yellowish or greenish, thus looking like bruises; this explains the title given to this affection by some authors—dermatitis contusiformis. The disease always extends into the deeper parts of the cutis and the connective tissue; hence movements of the affected extremities are painful. The onset of the malady is usually complicated with general symptoms and very intense prodromal phenomena, and consequently the affection is classed as pyrexial. However, being not rarely connected with inflammations of the joints or rheumatic incidents, some physicians have been led to look upon erythema nodosum, like purpura rheumatica or the erythema multiforme connected with rheumatic symptoms, as a disease due to a common cause (Durian, Legrand). Bohn[1] has designated erythema nodosum an embolic skin disease without furnishing any material proofs for this assumption; he based his opinion upon Panum's investigations, that small coagula now and then arise within the circulation, as well as upon the coincidence of erythema nodosum with venous thrombi in the lower extremities and presumably in the kidney (?), in accordance with his own observations in some cases. This coincidence, however, might only be quite accidental and has received no further confirmation. The coloration of the nodes would speak rather in favor of an exudation of blood into the tissue, as would the tension in the affected portion of the skin; still it is difficult to trace the disease to an embolic or hemorrhagic source. In our opinion, the color is due to transudation of blood, and erythema nodosum is to be looked upon as an affection distinct from erythema multiforme; although the several forms are sometimes observed to merge into each other, still the development and course of the disease show certain differences from multiform erythema, so that Neumann's view, to consider the affection an idiopathic one, is not to be altogether discarded. As the tension relaxes, slight fluctuation is exhibited in the node in its further course, but suppuration of the nodes never occurs or quite exceptionally (Uffelmann).

The *course* of erythema nodosum is much slower than that of erythema multiforme; despite the usually rapid appearance of the disease, the development of the nodes seems to require a longer time, and several weeks generally elapse from the beginning to the total involution of the nodes. The fever, which may at first reach a considerable height (41° C.), remits much sooner than the articular pains or the gastric conditions accompanying the outbreak of the skin disease. The articular affection is a conspicuous symptom and is seldom absent; still, as a rule, there is no inflammation of

[1] "Embolische Hautkrankheiten," Jahrbuch f. Kinderheilkunde, 1864, Heft 4.

the heart muscle, nor of the valves or pericardium. In particularly severe cases, there are ulcerations of the mucous membranes, inflammations of the serous membranes, pleuritis, endocarditis, with eventually fatal termination. The involution of the nodes occurs always with decrease of the tension and the pains in the skin; the dark or bluish color changes into violet, light-yellowish; the doughy, soft tumor becomes gradually more consistent, and the skin slowly regains its normal appearance.

The *anatomical alterations* show an infiltration of the skin extending into the subcutaneous connective tissue and exudation of blood in the region of the node. The capillaries are very full, the lymphatic vessels swollen and amply covered with lymph-cells. Here and there extravasations are found.

*The Diagnosis*

of erythema nodosum is based chiefly on the above-described dark-red or bluish nodes which, should they occur on the nates or elsewhere on the trunk, might easily be mistaken for bruises caused by contusions. Hence the form of the tumors should be noticed; the swellings due to trauma usually exhibit wheals, the tumor extends longitudinally, but shows no circumscribed formations of lighter color at the periphery than at the centre, and blending with the surrounding hue of the skin. Should pyrexial conditions accompany the erythema and articular pains be present, the recognition of the disease is facilitated. A mistake with syphilitic nodes is hardly possible if attention is paid to the manifestations of syphilis on the skin and the mucous membrane. The painfulness of the recent erythema nodes is so constant a phenomenon that, in a possible case of doubt in regard to syphilis, it may likewise be utilized.

*The Treatment*

is mainly directed against the pain, which may be best moderated by cold in the shape of ice or water applications, with or without Goulard's lotion. In this form of erythema a general tonic treatment is indicated—quinine, iron, wine pro re nata; rest in bed is to be strongly recommended while the acute painful stage continues. For violent articular pain the salicylic acid treatment is appropriate (three to five grams daily). Every care should be had in this disease to employ the appropriate remedies and to attentively watch the symptoms accompanying the cutaneous affection.

4. *Urticaria, Nettlerash.*

Urticaria is a peculiar cutaneous affection characterized by efflorescences (wheals) ranging in size from a bean to a thumb-nail, firm to the feel, pale-red or whitish in color, and elevated above the level of the skin. It usually appears suddenly, is of brief duration, or changes to a chronic condition, causes violent itching, and progresses without desquamation.

The onset of the disease occurs at times without prodromata, at times is preceded for a few hours or one to two days by general depression, malaise, nausea, fever, and headache, after which the roundish or oval elevations appear on the skin, which are characterized by their above-mentioned circumscribed coloration. The peculiar burning on the skin, as well as the slight or temporary swelling, is shared also by the eruption caused by the common nettle (Urtica urens), whence the title.

The efflorescences of urticaria present manifold forms in the manner of their occurrence, their extent, and their duration. The wheals may be scattered over the surface

without being confluent, they may be close together or they may be nodose resembling erythema or the exudation into the underlying connective tissue. According to its duration, the disease has also been called urticaria febrilis s. evanida, when the efflorescences disappeared soon after the remission of the fever accompanying the eruption; as opposed to urticaria perstans s. chronica, urticatio, which progresses without fever and in which the wheals alternately occupy different surfaces at succeeding intervals.

The color of the wheal is red when the papillary body is hyperæmic or white when it is bloodless. The single efflorescences usually spread in groups, wandering from one portion of the skin to another; thereby the skin appears bloated, reddened, and the manifold outlines resembles a map on which hills and valleys are plastically represented. A peculiar form of urticaria is urticaria intermittens, in which the disease occurs in a series of days and weeks, always at a certain time, and then again completely vanishes; thus, owing to the simultaneous symptoms of fever, the urticaria appears merely as a concomitant of intermittent fever. At times, however, urticaria occurs without fever in as definite intervals as a quotidian or tertian fever and may be made to disappear by the use of quinine. In rare cases urticaria also shows itself on the mucous membranes, and Milton[1] described a few cases in which the mucous membrane of the mouth, pharynx, and trachea as well as the common integument were covered with an eruption of large wheals, which form he therefore called gigantic urticaria. Cases of temporary reddening, which, however, are followed by rather intense pigmentations, are rare (urticaria pigmentosa).

*Pathological anatomy* has hitherto furnished no sufficient explanation of this morbid condition, because the post-mortem table gives no opportunity to examine an affection which subsides so quickly; it is not yet decided whether the formation of wheals is brought about by a rapid transudation into the layers of the cutis or whether it is the result of a simple congestion. Vidal's investigations speak for the former view, because he found the cutaneous vessels corresponding to the wheals greatly dilated and replete with blood without any alteration in the vessel walls; but in the neighborhood of the vessels white blood-corpuscles were accumulated in larger masses and the lymph-vessels were also filled with them. These anatomical data furnish material explanation of the morbid process. Every morbid factor followed by a nettlerash excites the termini of the sensory nerves extending in the external skin or in the mucous membrane; they excite the vaso-motor nerves in a reflex way, cause the capillaries to contract, and by the succeeding paresis incite the transudation in circumscribed regions, thus producing the wheal which, accordingly, represents nothing else but a circumscribed œdema.

### *The Diagnosis*

will be easily formed from the wheals and the nervous sensations associated with them—burning, stinging, itching. But there is a series of other diseases which may lead to mistakes.

Among these belong:

*a. Lichen urticatus, or urticaria papulosa.*

This affection is pathologically related to urticaria and characterized by the eruption of nodules from a hemp-seed to a lentil in size which soon change into smaller wheals. Bateman first introduced the term lichen, because the efflorescences are smaller, in the

[1] Vierteljahrsschrift f. Dermatol., 1877, p. 585.

beginning resembling gnat and insect bites, and do not enlarge if left alone, were it not that the simultaneous intense itching irritates the skin so that larger efflorescences often develop from the small nodules. Lichen urticatus, therefore, represents a mixed form between nodules and wheals, sometimes the one, sometimes the other predominating. A concomitant symptom is the intense itching and whenever the effects of scratching are seen, it is not impossible to mistake it for papulous eczema and prurigo. But such a diagnostic error cannot last long, because urticaria papulosa is always of shorter duration than the affections named, because wheals are not formed in eczema and in prurigo only in recent eruptions or relapses, but not in a long-standing disease.

*b. Erythema.* This we have described in its various stages as erythema multiforme, but in none of them does it develop from wheals. Its efflorescences persist throughout the course of the disease, there is an absence of the severe itching peculiar to urticaria, and the desquamation, even if slight, can always be demonstrated whenever the nodes and nodules resolve. Lichen urticatus and erythema can be mistaken for one another only when there are temporarily no wheals in the former.

*c. Erysipelas* shows a diffuse redness with considerable swelling of the skin, is a more prolonged disease, and is attended at most with vesicles. The process lasts a few days or more, with subsequent marked desquamation.

Diagnostically it is also of importance to ascertain whether the formation of wheals or nodules—which change into the former—has been caused by external irritations affecting the skin (drugs, electricity, insects) or not. Furthermore it should be noted that, as in prurigo eruptions of wheals introduce the affection, so now and then fine urticarial efflorescences may appear in pemphigus (pemphigus pruriginosus). When urticaria occurs acutely, it should be borne in mind that it sets in preferably by night, and that by day the remnants of the efflorescences can barely be found ; only in the chronic form we find also during the day the excoriations due to scratching, pigment spots, and often discrete or confluent wheals ; this latter affection, known by the name of urticatio or chronic urticaria, is an exceedingly annoying malady on account of its pronounced chronic tendency.

### *Etiology.*

The causes inducing urticaria, whether direct or indirect, in every case are such as exert quite a special effect on the vaso-motor system, partly in toto, partly on some portions of it. The direct causes affect the peripheral expansions of the cutaneous nerves themselves, while the indirect ones act as irritants on the skin by the absorption into the blood of the morbid agent. Among the direct causes we include those which have been proved to produce the appearance of wheals after a mere external influence ; of course, the disposition to the cutaneous affection is dependent on the sensibility of the skin. Delicate individuals, women and children, therefore, react more easily on certain irritations than robust or vigorous persons. Stronger irritations than simple pressure are the effects produced by cold and electricity. Both agents in the beginning irritate the vaso-motor nerves and induce anæmia ; then this changes into a quasi-paralytic condition, with hyperæmia ; and then, according to the cutaneous sensibility, urticaria wheals break out. In an analogous manner pungent substances produce urticaria, such as touching the skin with the common nettle (Urtica urens), with Rhus toxicodendron, and similar objects ; furthermore, stings of insects, caterpillars, mosquitoes, fleas, bugs, all of which provoke eruptions of wheals on more or less extensive surfaces according to the intensity of the influence.

The indirect causes of disease are far more numerous.

*a. Febrile conditions.* Children while teething and suffering from fever as a concomitant phenomenon of this process often exhibit a reflex morbid state in the shape of wheals manifesting themselves on the second or third day of the affection. Adults subject to rheumatic attacks are often seized with urticaria, and frequently the eruption appears simultaneously with the rheumatic exacerbations.

*b. The ingestion of various articles of food or drugs* (urticaria ab ingestis). In some individuals we find a peculiar idiosyncrasy against certain alimentary substances. These aliments include almost exclusively such as are partaken of as luxuries; for instance, oysters, crabs, smoked or salted sea-fish, crayfish, caviare, mussels, pungent spices, etc., also champignons, strawberries, and other fruits; a similar effect is produced by ordinary alimentary substances and tidbits when partaken of in excess.

Of drugs it is especially the balsams (such as copaiba, tolu, and turpentine), and belladonna, which may provoke, besides urticaria, also erythemata and other exanthems.

*c. Excitement by moral influences*, as: fright, grief, anger, and other violent mental emotions. Gibert relates of a newly married woman who, at a ball, was offended by unseemly insinuations, and was suddenly attacked by a confluent urticaria covering the neck, breast, and shoulders, which forced her to leave the place of entertainment. Similar cases are not so very rare. Not long ago, Stampacchia[1] published a case of very intense urticaria connected with manifold nervous disturbances, which had led to considerable anæsthesia of the left lower extremity, the causative factor of which could with certainty be assumed to be deep grief over the loss of a child.

*d. Anomalies in the functions of the sexual apparatus, as well as of the respiratory and digestive organs.* The former were mentioned by the older physicians, who stated that urticaria occurs often previous to the onset of menstruation, with genital affections, after abortions, etc. Paul and Gueneau de Mussy[2] called attention to a connection between disease of the respiratory mucous membrane and attacks of urticaria; they report a series of observations of bronchitis spastica, or asthmatic attacks, in which the latter remitted whenever urticaria broke out. Affections of the mucous tract of the digestive organs, however, must also be looked upon as causes of irritation. Thus Litten,[3] in a case of icterus due to gall-stone colic, on two different occasions observed an attack of urticaria during the passage of the stones through the ductus choledochus, which disappeared immediately after the cessation of the colic. In a second case, the same author, in an individual suffering from tænia, several times noticed an eruption of urticaria whenever pieces of the worm passed in greater quantity. In a case of echinococcus of the liver, Lerebouillet[4] witnessed an eruption of urticaria with every tapping.

In view of the fact that in urticaria, besides the wheals, we see as concomitants also the formation of nodules (lichen urticatus) and persistent erythemata, but no vesicles, hemorrhages, or ulcers in its train, we must exclude a deeper implication of the nerve centres and seek the seat of the disease in the peripheral nerves.

### *Prognosis.*

Urticaria does not belong to the dangerous diseases, but in its chronic form it is an exceedingly annoying malady. In children and infants the sudden occurrence of urti-

[1] "Un caso di Urticaria con perturbamenti nervosi." Annal. de Dermatolog., 1881, p. 150.

[2] Gazette hebdomadaire, 1881, No. 7.

[3] Charité-Annalen. Berlin, 1879, p. 200.

[4] Gazette hebdomadaire, 1881, No. 16.

caria, if conjoined with fever, often has an alarming effect on the attendants; in this case caution is necessary lest a hasty diagnosis of graver affections be made. Even in its chronic forms urticaria has never any bad sequels; to be sure, it is often excessively prolonged, is at times hard to eradicate, but never causes any grave conditions.

*Treatment.*

In the acute form, a special treatment is often not necessary, the expectant plan being sufficient. The general depression and the fever are rarely grave enough to force the patients to keep the bed, and it is advisable, should the patients desire, to permit them to take out-door exercise. Even if due to a gastric cause it will hardly be necessary to give an emetic, but rather a light laxative according to the conditions. Patients first attacked by urticaria after partaking of a certain food, without knowing the cause of the malady, must be reminded of it so as to guard against relapses. In obesity, catarrhal conditions of the stomach and intestinal tract, suitable treatment must be instituted, any stases present be made to disappear, and laxative waters be recommended according to the indications; but only when we have to deal with persistent, oft-recurring forms of the disease. In this sense the waters of Marienbad, Karlsbad, Vichy, Kissingen, Wildungen, Püllna, and Ofen are indicated, but we must guard against excess. In affections of the genitals and female diseases, the necessary indications are given. In intermittent fever in connection with urticaria, quinine should be given; salicylic acid in rheumatic complications, especially of the joints.

With what has been stated the treatment of urticaria is by no means exhausted; for in this affection, especially in its chronic forms, we are forced to a direct treatment in addition to general measures, owing to the itching. An excellent remedy is cold water, partly in the form of ablutions, partly as douche, partly, where there are copious nodular eruptions, in the shape of compresses. If the patients can bear the water, the itching soon diminishes, and the swelling usually goes down rapidly. The water may also receive additions of vinegar, aromatic spirit, spirits of wine, etc. Warm baths are generally useless in urticaria, but from prolonged lukewarm baths of 24–25° C. I have seen soothing effects during their continuance, but seldom beyond it. Besides, we may employ for lotions a number of external remedies which are generally useful in itching diseases such as:

℞ Acid. carbolici, 2 grams; Glycerini, 20 grams; Alcohol. rect., 200 grams.

℞ Acidi salicyl., 10 grams; Alcohol. rect., 200 grams; Bals. Hoffmanni, 50 grams.

℞ Chloral. hydrat., 5 grams; Aq. laurocerasi, 50 grams; Aq. dest., 200 grams. (Vidal.)

It is preferable, however, on account of their longer contact with the skin, to order ointments rather than lotions; for instance: Lactis sulphur., 5 grams; Ol. cadini, 10 grams; Ung. emoll., 60 to 80 grams. Or, Naphtholi, 2.5 grams; Ung. crême cœlestis, 50 grams. In some cases these remedies prove effective, if well rubbed in, two or three times daily, and the patches are amply dusted with starch or pulv. oryzæ.

But as the drugs mentioned, and many others besides, often fail in chronic urticaria, the attempt has been made to overcome this troublesome disease by internal medication. Aside from the potions, mineral acids, aconite and arsenic used by the older physicians which may now be looked upon as obsolete, excepting perhaps the last, some of the medicaments recently recommended deserve to be noticed, such as hydrobromate of quinine (Vidal), 50 to 60 centigrams per day, from which the author has seen very favorable results; furthermore, salicylic acid, 3 to 5 grams per day, and atropine. The latter drug

proves at times extraordinarily effective in the dose of 0.001–0.002 gram per day; of course, atropine must be exhibited with the necessary care. My prescription reads: ℞ Atropin. sulph., 0.01 gram; Glycerini, Aq. dest., āā 2 grams; Gummi tragac., q. s. ft. pil. No. xx.

In a few cases the affection recurred when the remedy was stopped; but where it could be used in corresponding doses for a longer time, the urticaria finally remained away in cases which had extended over a period of from three to five years.

## III. NEUROTIC AND TROPHONEUROTIC DISTURBANCES.

The cutaneous affections belonging to this group depend upon disease of nervous elements; they form disturbances on the one hand acting on the nutrition of the skin, on the other they are distinguished by manifold neurotic complications in the sensory sphere.

It is difficult to furnish scientific proof that the nutritive disturbances are caused by a certain category of nerves—the trophic nerves; but we cannot deny the assumption that they exert an influence in the production of numerous cutaneous diseases. Even Cohnheim, who occupies a very sceptical position in reference to this question, says, in speaking of some cognate cases, "that a true and indubitable trophic influence of certain nerves and nerve centres cannot be disputed."[1]

Among the conditions to be considered trophoneurotic diseases belongs a series of inflammatory conditions, with or without the formation of efflorescences, ulcerative processes, and structural affections of the skin; but of the large number of affections falling under this head, we shall confine ourselves only to those diseases which present at the same time a neurotic and trophoneurotic character.

In the foreground of trophoneurotic affections stands:

### PRURIGO.

Formerly the terms prurigo and pruritus were looked upon as synonymous, and every disease associated with itching was called either an itching or a scratching affection (prurire and scabere, whence prurigo and scabies).

Willan and Bateman first restored prurigo to an independent position, and designated the nodular forms as prurigo mitis and formicans; those occurring without nodules as pruritus localis and senilis.

This classification of prurigo, with a few exceptions, is still current in France and England; only the Vienna school, since the time of Hebra, has completely separated prurigo cum papulis as a true cutaneous disease from prurigo sine papulis or pruritus. The English have gone so far as to assert that, inasmuch as Hebra's description of prurigo does not refer to prurigo so called in England, prurigo of the Germans is a different affection from prurigo of the English; but the last International Congress gave the opportunity to obliterate these quasi-differences.[2]

*Symptoms and Course of Prurigo.*—The disease we call prurigo consists in the presence, mostly on the extensor surfaces of the extremities and less on the trunk, of numerous discrete nodules, having at first the color of the skin, and gradually darkening;

[1] "Vorlesungen über allg. Patholog." Berlin, 1882, i., p. 518.

[2] Transactions of the Internat. Med. Congress, London, 1881, III.

they are from a millet to a hemp seed in size, and occasion violent itching; after a brief existence, they are freely intermingled with excoriated efflorescences. The disease appears in earliest infancy, and has a chronic course; it is nearly always preceded by wheal-like efflorescences, which are never absent, besides, in relapses of the disease.

The prurigo nodules are distinguished from the nodular eruptions of eczema papulosa, erythema, and scabies, chiefly by not being spontaneously transformed into other efflorescences, and the fact that throughout their whole existence they change neither into vesicles nor crusts, but appear, even if the affection last for years, as mostly flat, slightly reddened elevations, or perish in the subsequently forming infiltration of the skin in case the disease extends greatly. The deeper layers of the cutis form the seat of the nodules, and thus it happens that the intense subjective sensations are often perceived before changes can be seen on the integument. This fact probably made prurigo appear identical with pruritus; but if such a case be followed in its further course, the difference in the affection becomes marked, and while in pruritus the skin seems altered at most by excoriations, in prurigo the nodules will manifest themselves early, and largely increase in number.

The most prominent symptom in prurigo is the continuous violent itching which may reach so high a degree that the patients suffer the most unbearable nervous complications, and cases are known where some unfortunate people were driven to insanity and suicide by it. The sensations provoked by the itching are very manifold, and manifest themselves chiefly at the places most affected; often, however, owing to the fixed irritation, the skin is attacked in its totality, even on parts quite free from efflorescences, and then the sensation becomes one of general pain and discomfort, described by the patients in the most glowing colors, and despite the comparatively favorable physical conditions as regards nutrition and assimilation, the vital processes are seriously impaired. Some patients feel tolerably well by day, but as soon as they seek their bed at night, the unbearable itching commences; the patients often sit in bed for hours, tearing their skin and detaching the nodular efflorescences with their nails, so that here and there the upper epidermal layers appear covered by crusts of dried blood. It is not so much the evening or night time which causes the increase of the nervous sensation, but rather the heat of the bed which awakes the temporarily dormant irritation of the skin, and, when once aroused, permits its alleviation only with difficulty. I have observed cases in which the patients had been more weakened and reduced by the continual sleepless nights than by many a dangerous acute disease. Equally irritating are warm or close-fitting garments, at times also increased temperature of the surrounding air.

The sequels of prurigo manifest themselves on the skin by considerable alterations on its surface; for, both by the persistent itching and the frequent scratching, the skin becomes firmer in its texture, dingy, lustreless, and loose exfoliations of the epidermis form, which cover the entire diseased surface. Such alterations arise only gradually, and where they are found we may presuppose that the affection has existed several years. In a skin changed by an old prurigo we find an almost entire absence of the pruriginous efflorescences, and will be inclined rather to take the actual morbid picture for a squamous eczema or an ichthyosis. The experienced practitioner will probably at once recognize the differences; but even the less expert will soon be able to make a correct diagnosis if he bear in mind that prurigo presents peculiarities which do not belong to other diseases. If the prurigo be of long standing, the further alterations occurring are such as are found in chronic eczema, and very frequently we can find besides the prurigo the

secondary eczema which is characterized by scabs, crusts, and weeping surfaces. In this way, therefore, the original morbid picture might appear hidden and transformed by the sequel. In addition to this, we have the fact that in universal prurigo the places generally spared by it, such as the face and nucha, are likewise attacked by eczema; and if we closely examine the skin, we shall soon be able to distinguish the portions first affected from those subsequently attacked.

The pruriginous skin, moroever, presents a peculiarity in its darker pigmentation which is likewise provoked by the above-described symptoms, and more especially by the intense and continuous scratching ; the same fact may be observed also in inverate scabies or long-standing prurigo pedicularis due to the pediculus vestimenti.

We must mention one more phenomenon which is never absent in an affection of long standing—the visible swelling and enlargement of the larger lymphatic glands ; this stands in relation to the infiltration of the diseased surfaces and probably also to the irritation caused by the scratching. We find this state of the glands much more frequently in chronic prurigo than in prolonged scabies or eczema; it is also present in eczema of the scalp, but absent in psoriasis or other chronic dermatonoses. The swelling of the glands depends on the gravity and the duration of the affection As to the age of prurigo patients, experience teaches that the majority of prurigo sufferers exhibit this morbid state from the earliest period of life to adolescence and beyond. This fact *per se* indicates a special gravity of the morbid process, which has induced many observers, and Hebra among the rest, to make the statement that prurigo is an incurable disease lasting throughout the whole of life. But the experience of many physicians, especially of the Vienna school, shows that prurigo in early age is much more easily cured than if it is neglected in this stage and comes under treatment when the patient has reached adolescence.

*Prurigo of the aged* (prurigo senilis) really coincides with cutaneous itching, pruritus, because the characteristic factor, the formation of nodules, occurs not as a primary, but as a secondary phenomenon. For in this disease we find a very intense itching with numerous excoriations and few nodules ; the latter in fact appear as papillary bodies of the skin swelled by the itching. The same remark applies to the local prurigo of the female and male genitals described in older works.

### *Anatomical Changes.*

The more recent anatomical researches into this subject show actual disease of the skin and its appendages, as has been fully demonstrated by Neumann and Derby,[1] and especially by Gay.[2] The former found the hairs and their follicles very conspicuously altered, the hair thinned, the root-sheath loosened, and surrounding them an exudation into the corium and the papillæ, a thickening of the papillary body around the hair-follicle and the sebaceous glands by an accumulation of cells, with protrusion of the rete Malpighii. These investigations agree in so far with the condition of the prurigo nodules as the latter almost invariably seemed pierced by a hair and thus *a priori* led to the supposition of an alteration of the hair as involved in the pruriginous disease. Gay showed that the thickness of the horny layer caused by the plastic process is very conspicuous. In the later stage of the disease the sebaceous glands generally atrophy and the sudoriparous glands dilate by ample cell development in their efferent ducts and in the glandular canal proper.

[1] Sitzungsberichte der kaiserl. Academie zu Wien. 59 Bd.

[2] Arch. für Dermatologie, 1871, iii., pp. 1 et seq.

*Diagnosis.*

The morbid conditions manifested in prurigo can be mistaken only for scabies, eczema, and urticaria, but then merely in the beginning of the affection ; such diagnostic errors are in fact not rare. With reference to scabies, examination will easily clear up the case, for the burrows of the parasite are visible in the shape of wavy stripes, one to two lines in length, slightly raised above the level of the skin ; at the end of the track darker colored points can at times be observed (excrement of the acari). Therefore, those parts of the body should be carefully examined where the tracks are usually most frequent, *i. e.*, between the fingers, the genitals, the nipples, and those parts of the trunk around which the clothes are tightened. But in long-standing and extensive scabies, the parasitic burrows are often totally destroyed, and traces of recent tracks can hardly be found anywhere ; but in such cases we will be assisted by the knowledge of the secondary symptoms of the disease as occurring in scabies, as well as by the pustules and vesicles on the extremities, scratch-marks on those parts of the skin where prurigo generally does not appear, such as the genitals, the palm of the hand, and some parts of the trunk.

Only the papular form of eczema could be mistaken for prurigo, but it rarely occurs as extensively on the extremities as prurigo, and besides, the former affection presents manifold forms as transitional stages, *i. e.*, the transformation of the efflorescences, the nodules, crusts, pustules, and serous exudations changing into crusts. It should not be forgotten that eczema presents quite different factors from prurigo as regards development, course, and duration; while, in the latter, trunk and face are more or less spared, this is not the case with eczema ; fingers and toes are intact in prurigo, but not in general eczema ; in the latter the flexor sides of the extremities are also less affected. Eczema, no matter how intense, clears up spontaneously here and there, prurigo does not.

Urticaria can be mistaken for prurigo in the first stages or in recent outbreaks only if hastily examined ; for, in prurigo, nodules are always found with the urticaria wheals ; besides, the wheals are of short duration, and at the places where they have developed into nodules they do not relapse, as is the case with urticaria.

*Etiology.*

No indisputably certain landmarks as to the nature of the disease have been secured to the present day.

The older physicians believed that the irritating substances remaining in the organism, through impaired activity of the kidneys, furnished the incentive for an outbreak on the skin of an eruption impregnated with these substances.

Skin diseases connected with itching were also regarded as the outflow of a peculiar constitution of the blood, the so-called psoric dyscrasia. Assumptions of this kind are just as common-place as the view that prurigo is due to emotional affections, the nervo-sanguine temperament, taking cold, malnutrition, pungent drinks, atmospheric influences, etc.

Without entering further into the discussion of obscure causes, we shall proceed to the interpretation of the intense itching. Hebra believed the itching to be the consequence of a circumscribed exudation within the hair-follicles or the sebaceous glands which presses on papillary nerves and causes the irritation ; but this view is negatived by the analogy of some efflorescences which frequently appear without this symptom.

Cazenave,[1] therefore, has explained the matter by relegating the exciting cause of the affection to the nervous system, in consequence of which there appear great hyperæsthesia with its sequels; accordingly the itching is the primary, and the nodular eruption, caused by the scratching, the secondary trouble. Hebra's objection to this view is, that the itching always sets in after the presence of the nodular eruption; but this does not hold good for all forms of prurigo, because in chronic cases with very slight and here and there even absent nodular eruption, we still hear the patients complain of intense itching.

Wilson is likewise inclined to consider prurigo as a neurosis. Auspitz,[2] however, has pleaded most thoroughly in favor of the neurotic nature of this malady and called it a true idioneurosis. He finds the histological alterations insufficient by far to explain the itching, and reaches the conclusion that, as regards prurigo, we must adhere to the idea of a neurosis of sensibility just as we do in pruritus cutaneus, but with this difference that in pruritus there is an absence of the cellular hypertrophy around the glandular formations, but, by the simultaneous hypertrophy of the smooth muscular fibres in prurigo, there is caused a sort of neurosis of contractility.

Respecting the idea of a neurosis we fully agree with Auspitz, but on the other hand, we look upon prurigo as a trophoneurosis, and for the following reasons: In recent cases, we find, preceding the nodular eruption, almost invariably an eruption of urticaria. The experienced practitioner knows this precursor of prurigo quite well; this symptom is distinguished from the angioneurotic form of pure urticaria by the persistence of the eruption and its transition into another papular form. Moreover, we find in severe prurigo that the nutritive disturbance of the skin is expressed even in its texture: it is lustreless, faded, shows an undeveloped or ill-nourished subcutaneous tissue; the outbreak and the continuance of the efflorescences with their sequels impart to the common integument the appearance of a diseased surface, and for this reason we might admit, in a restricted sense, the idea of a diathesis such as is ascribed to prurigo by French dermatologists. It has been most correctly named by Guibout,[3] a cachectic form of disease. Indeed, it is difficult to discard the idea that prurigo is a congenital disturbance of nutrition which might be called a cachexia; which, although not leading to marasmus, still if left to itself may persist as a grave general disease, while, on the other hand, it can be removed by prolonged and attentive treatment. The immediate and anatomical demonstration of the change in the peripheral or central nerves has hitherto not been furnished; but this proves nothing against our assumption.

### *Prognosis.*

The disease does not admit of a favorable prognosis in general. The incurability of this affection, however, is merely relative. While on the one hand prurigo can in many cases in so far be ameliorated by appropriate treatment that the patient may be relieved for some length of time; on the other hand, in the majority of cases in children, prurigo can be cured. I have seen numerous cases in the latter disappear after several years' treatment.

In adults, prurigo is to be considered a disease dating from infancy, rarely of later development, but then only with difficulty curable.

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[1] Annales des maladies de la peau. Paris, 1844, II.

[2] "System der Hautkrankheiten." Vienna, 1881, p. 105.

[3] "Leçons cliniques sur les maladies de la peau." Paris, 1876, p. 46.

*Treatment.*

The treatment of prurigo may be attempted by internal and external means.

Of internal remedies arsenic alone may be tried in the dose of one to two centigrams per day gradually increased; in our opinion it may do good service as auxiliary to a local treatment, but it often fails both alone and when combined with external remedies. Some time ago Kaposi[1] (Dr. Kohn) tried carbolic acid in a larger series of cutaneous affections associated with violent itching. He started with the idea that tar and its preparations, which externally form valuable remedies, may also prove useful internally. He tried carbolic acid in pill form (℞ Acid. carbolici, 5 grams; Pulv. et Extr. liq., q. s. ft. pil. No. 50), both in children and adults, starting with from five to ten per day. According to the statements made (l. c.), the remedy was serviceable in numerous cases, and proved of use in prurigo without any external treatment, but later experiments have not confirmed these results.

Potassium bromide[2] is said to have proved useful now and then, and an Italian physician claims to have seen rapid cure of prurigo by daily doses of ten to twelve grams. Oscar Simon[3] and Pick[4] recommend pilocarpine, 0.01 gram daily subcutaneously, and this has given good results in my hands in numerous cases. The same may be said of ergotin in doses of from 0.05 to 1 gram per day. Narcotics, such as opium, lactucarium, hyoscyamus, chloral hydrate, chloroform, are of no use in prurigo.

The number of external remedies in ordinary use is greater than that of the really serviceable ones, of which we specially mention: water, and the preparations of sulphur and tar.

Water may be used in the form of cold lotions or warm baths, but we recommend the latter as undoubtedly the more useful of the two. Tub-baths permit the patients to submit the affected surface *in toto* to the soothing influence of the water at a mild temperature of from 22–26° C.; the longer the patients remain in such a bath the more soothing it acts, and this fact alone clearly brings out the difference between eczema and prurigo, both of which represent morbid processes distinguished by intense itching.

In eczema, the warm bath increases the hyperæmia of the skin; in prurigo it moderates it. The longer the patient can remain in the bath, the more favorable it is for his condition; this also explains the effectiveness in many chronic cutaneous diseases (prurigo among the rest) of the prolonged baths as used for many years in Switzerland, where the patients can stay in the baths from six to eight hours continuously.

Such protracted baths, of course, may also be taken at the various thermal spas, provided they do not contain strongly irritating ingredients, as do the iodine, iron, and saline baths. As sulphur likewise exerts a favorable effect on prurigo, and as it is immaterial in what form we employ it, sulphur baths may be placed first in the list with the indifferent thermal baths. In our experience, baths are not only an excellent, but even an indispensable remedy for prurigo, and with it we combine the other agents, according to choice and applicability.

In cases where there is no river or soft water at our disposal, it is best to mix it with carbonate of soda, one or two pounds for a bath for an adult, which does not interfere with the simultaneous addition of sulphur or tar preparations. An effective remedy

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[1] "Ueber den innerlichen Gebrauch der Carbolsäure." Archiv für Dermatologie, 1869, p. 219.

[2] Schmidt's Jahrbücher, 1871, iv., p. 164.

[3] Berliner klin. Wochenschrift, 1879, No. 49.

[4] Vierteljahrsschrift für Dermatologie, 1880, p. 67.

easily incorporated with the bath is tar, and the so-called tar baths are often of more use in prurigo than in psoriasis. The tar bath is taken thus: The affected surfaces are painted in part or *in toto* (the latter is to be avoided, owing to the absorption of the tar, with subsequent symptoms of intoxication) with a solution of tar in ol. cadini or rusci; the patient then gets into the bath, remaining one-half to one hour, then washes thoroughly, and slightly rubs simple ointment or vaseline into the skin.

The sulphur and tar remedies may be employed in prurigo with or without baths. Patients with moderate prurigo may take a simple prolonged full bath, subsequently rubbing in some sulphur or tar ointment; for instance: ℞ Lactis sulphuris, 5 grams; Ol. cadini, 2.5 grams; Glycerini, 10 grams; Ung. simpl., 40 grams; M. S. ointment; or ℞ Naphtholi, 3 grams; Ung. simpl., 60 grams (Kaposi). Dusting the anointed parts with a mixture of starch and rice-flour facilitates the intimate contact of the ointment with the skin. In more intense prurigo, with considerable infiltration of the skin and copious crust-formation, the affected parts may be well rubbed with soft-soap or solut. Vleminckx previous to the bath, and subequently anointed with sulphur-tar ointment. When improvement has set in, the soft soap may be omitted, and we employ only the tar baths; subsequent to each bath the skin is greased with simple cerate or fat. In many patients, besides, the itching is diminished by wearing close-fitting under-garments of tricot or flannel, as well as caoutchouc clothing.

When the itching is most intense at night, the patient is to use the baths with the other remedies in the evening before retiring.

Sublimate baths have not done me near as good service as the treatment above given.

By this plan, if persistently carried out, we have always secured improvement and temporary cure. But we are unable to prevent relapses, and in many cases we can do nothing but modify this treatment and, in intractable forms, we employ the several remedies for some length of time, and thus give the patient a better chance for improvement. The same method of treatment in a milder form applies to children as well as to adults.

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The vesicular and in part also the bullous affections are also trophoneurotic diseases, and vesicular eruptions break out after nerve lesions—a fact clearly denoting the neurotic influence in the formation of this efflorescence.

The type of the vesicular affections is

### HERPES.

In 1798 Willan and Bateman gave a clear and distinct definition of herpes which even to-day must be recognized as correct and appropriate. According to our present definition, herpes is a cutaneous affection, characterized by a series of transparent vesicles on a slightly reddened base; they are mostly the size of a hemp-seed, joined into groups, and follow the direction of some cutaneous nerves; they dry in the course of a few days (eight to ten), while their whitish serous contents become turbid; they disappear leaving pigmented spots of brief duration. When this process is several times repeated, this typical course is remarkable, but not especially characteristic; of far more importance is the painfulness which, however, generally occurs almost exclusively in herpes zoster.

*Herpes tonsurans* is a parasitic affection, and as such has in common with the vesicular dis-

eases here discussed merely the manner of its first appearance in the shape of vesicles and it would be more appropriate to designate it only by the term tinea or trichophyton tonsurans.

Willan divided herpes into several varieties, namely, herpes phlyctænodes, zoster, circinatus, labialis, præputialis, and iris. This division corresponds to the natural condition and might be retained even to-day; but as the ἕρπης φλυκταινώδης is nothing but the generic term for vesicular affections, herpes phlyctænodes really represents no variety, and therefore may be dropped. Hence we notice only the other species, and shall treat of them in the following order: 1. Herpes labialis; 2. Herpes præputialis; 3. Herpes zoster.[1]

1. *Herpes facialis* (*Hebra*); *Herpes labialis* (*Willan*).

The term herpes facialis derived from Hebra is far more appropriate than that employed by Willan; for, although this form occurs most frequently on the lips, it appears also on other parts of the face, such as the cheek, the nose, the eyelids, and the ears. The number of the vesicles joined into groups is not constant; their appearance is usually preceded by a faint redness (erythema). Should herpes occur simultaneously on the upper and lower lip, it is called herpes bilateralis. On the lip the vesicles are usually found near the vermilion border; the several efflorescences are not always sharply defined; the outlines blend, and we then see, instead of numerous small vesicles, a single bleb often the size of a pea. The contents of the vesicles usually dry after three to six days into a brown or yellowish crust which falls spontaneously. If the crust be detached before it has dried up, the healing is rendered more difficult, a red weeping surface remaining behind which dries into a still more firmly adhering scab.

It is customary to consider herpes labialis as the consequence of a morbid disturbance within the organism, and it cannot be denied that herpes at times shows itself in some febrile conditions, with the subsidence of the pyrexial symptoms. Often it is a concomitant of grave diseases, especially intermittent fever and inflammations of the thoracic organs.

In such cases it has no prognostic value, for grave diseases may equally often run a favorable or unfavorable course, without being at all associated with herpes.

Bleuler[2] collected the statistics of 216 cases of pneumonia in which herpes was present 88 times; among these, in 44 deaths, herpes was found 14 times—proof sufficient that herpes is not always to be looked upon as a favorable prognostic sign.

In some cases the herpes vesicles appear also within the mouth, on the mucous membrane of the tongue, the pharynx, the tonsils, but the presence of the vesicles there cannot always be clearly demonstrated, the oral secretion soon producing maceration of the thin mucous layer and destruction of efflorescences. In their places there appear on the mucous membrane reddish spots denuded of epithelium which are painful and render alimentation difficult. Often it is hard to distinguish herpes of the mucous membranes from aphthæ, and in that case it will be necessary to ascertain whether herpes is present on the external skin. This process is frequently connected with affections of the stomach or abdomen, and we must never fail to direct attention to this circumstance.

Herpes labialis is a quite painless cutaneous affection, and the slight tension and burning of the affected parts are its only disagreeable symptoms. Finally we must point out that not all kinds of herpes occurring in the face belong to facial herpes; but that

[1] Herpes iris and circinatus we have already described with the erythema of the same name.

[2] Bleuler: "Klin. Beobachtung über Pneumonie." Zürich, 1865.

herpes zoster may likewise appear in the face, especially in the region of the eyes (zoster ophthalmicus).

2. *Herpes Præputialis, Progenitalis* (*Hebra*).

It occurs both on the prepuce (the external or the internal fold) and on the glans penis. The skin is but slightly sensitive, at times itching, and the several vesicles are in groups or singly on a somewhat reddened base. After a brief existence, the contents of the vesicles become turbid, they dry and crust, so that the herpes is visible only in the first twenty-four to thirty-six hours of the disease; later, crusts, scales, or slight excoriations are all that can be found. These excoriations or somewhat moist spots, resembling ulcers the size of a hemp-seed, not rarely give rise to the suspicion, especially when they occur isolated, that we have to deal with specific ulcers and thus might occasion diagnostic mistakes.

This form of herpes occurs not only in men, but also in women, though much more rarely: and the vesicles or other excoriations are found on the vulva, together with considerable hyperæsthesia (herpes vulvaris s. pudendalis).

In order to avoid diagnostic errors between herpes progenitalis and syphilitic ulcers, the practitioner must exercise the utmost caution. Professional syphilographers have proposed to try inoculation in doubtful cases, knowing that syphilis, by auto-inoculation, produces chancre, while herpes cannot be inoculated. Such controlling experiments could be made in isolated cases, but as a general rule they are not necessary, if we bear in mind: *a.* The duration of the efflorescences (herpes heals within eight to ten days without leaving a trace behind), and *b.* the mode of treatment. Every cauterization of an herpetic excoriation may produce an indurated surface. It is best, therefore, in doubtful cases, to delay any active treatment and employ indifferent remedies—lead or zinc ointments (1 : 10), lead-water lotions, dusting with starch—until time enough has elapsed to clear up the diagnosis. But should it be found that the diseased spot enlarges, and a purulent secretion takes the place of a watery exudation, the presence of a specific ulcer will no longer be doubtful.

In most cases, we can determine, from the statements of the patients, that the outbreak of the efflorescences usually occurs a few days after the influence of certain irritating conditions (coition, onanism, pollutions). In some cases under my observation, the occurrence of herpes took place several times so obviously after coition that a connection between the genital function and the herpetic eruption seemed indubitable, and the increased irritability of the genital nerves could be suspected as the most intimate cause of the efflorescence.

Plumbe considers herpes preputialis the outcome of a disturbance of digestion; Bazin, the consequence of a diathesis; while other authors have specially emphasized its correlation with specific genital affections.

A few authors regard it as a neuralgic disease. But Mauriac's[1] conception seems to be very comprehensive; he, like Bärensprung, brought genital herpes into such an analogy with zoster as to look upon irritation of the sacral plexus as the real pathogenetic factor; but he is in error when he assumes an arthritic disposition in support of this view. The neuralgic cause in itself suffices to explain this malady, which, in the character of the vesicular eruption, clearly displays its etiological relations with the other herpetic affections.

[1] "Leçons sur l'herpès neuralgique des organes génitaux." Paris, 1877.

The peculiarity of herpes progenitalis of relapsing frequently is in no other species of herpes as pronounced as in this one, and the cause thereof is not clear; at all events, this observation deserves some consideration diagnostically.

### 3. *Herpes Zoster or Zona.*

*Symptomatology and Pathogenesis.* Zoster is an acute cutaneous disease, extending in the skin along the direction of a nerve-twig; it appears with groups of vesicles, is more or less painful, does not run a typical course, and ends by drying up of the vesicular contents and temporary change into another local process. The beginning of the disease is often preceded by general malaise and feverish conditions lasting a few days, and it is conjoined in some patients with fixed pain at some part of the body. After the lapse of one or two days, we find on the painful spot a reddened patch. But often no general indisposition precedes the cutaneous affection, and the patient's attention is attracted by some abnormal sensation in the skin. Zoster then appears in the shape of several vesicles joined into groups, six to eight or ten in number, looking like small whitish or yellowish pearls, filled with a thin serous fluid; for three or four days they remain stationary, at times they also increase, spread, or unite into larger bullæ. When the efflorescences begin to dry up, the vesicles become faded and limp, the underlying skin grows pale, and there are formed yellowish-brown, moderately thick crusts, which fall off spontaneously in a few days. This process is not uniform, for wherever zoster occurs, the groups of vesicles, according to the implication of the nerve-twig, continue to develop along the latter, so that the course of such morbid process may occupy from three to six weeks.

A concomitant phenomenon is often presented by violent neuralgias radiating in the direction in which the eruption spreads. At times the pains are of moderate intensity; in a few cases, however, they are of a terrible character. After sleepless nights and days passed in agony, the patients become dejected and weak, emaciate (in one of the cases under my observation the circumference of the body decreased in two weeks by twelve centimetres), and frequently require considerable time to regain strength after recovery.

Often the patients feel compelled by the violent pains and the accompanying itching to ease the affected portions by scratching; but thereby the vesicles are torn open, and thus ulcers form which at times are slow to heal. Not rarely, however, ulcers occur without such external provocation, and this transformation of the vesicles is an important symptom in favor of the trophic nature of the affection. Many physicians had ascribed the pain to the pressure of the vesicles on the peripheral nerve expansions and sought the causes of the neuralgia in the anatomical condition of the cutaneous disease. However, this view had to be abandoned as soon as the existence of zoster began to be brought into causal relation with affection of central or peripheral nerves. At the present day herpes zoster stands as the type of a neurotic affection, for often coarse anatomical lesions are found in connection with it. The causes of zoster may be either of a traumatic or a pathological nature. The number of authors who have considered zoster a disease based on a neurotic disturbance is quite large.

Cases of zoster referable to a traumatic cause have been described by Rouget,[1] Rey-

[1] Journ. de Physiolog., 1859.

naud,[1] Oppolzer,[2] Verneuil,[3] Paget,[4] Weir Mitchell,[5] and many others. By such experience it came about that in cases where no trauma could be demonstrated, the causes of zoster were sought in other factors, and thus the knowledge was acquired that pathological lesions of the central nervous system are likewise followed by eruptions of zoster. The nature of zoster thus received its correct interpretation; for not only were the vesicular eruptions occurring with nervous symptoms on the trunk included in this dermatonosis, but those groups of vesicles on all parts of the body which followed preceding neuralgias and were confined to the direction of a nerve twig. Charcot and Cotard[6] have seen a case in which all branches of the cervical plexus on the right side were attacked by zoster, and at the autopsy the spinal ganglia and the nerve trunks were found swollen and injected, while the roots of the cervical nerves and the upper part of the medulla appeared perfectly normal; and thus eruptions of zoster may break out in the most various regions. Hutchinson[7] and Hybord[8] have grouped together a large series of cases of zoster frontalis and ophthalmicus, in which, besides the neuralgias, considerable disturbances of sight existed. Brown-Séquard[9] observed an intense eruption of zoster along the branches of the brachial plexus in a case of spinal meningitis. Bärensprung's[10] case is universally known; as early as 1861 he had thoroughly established the neurotic nature of zoster, and in a case of pectoral zoster he found at the autopsy an inflammation of the spinal ganglia of the posterior roots and the thoracic nerves springing from them. Bärensprung's assumption, that only the ganglia are affected in zoster, suffers some limitation by the fact that sometimes the intervertebral ganglia have been found intact, while the spinal cord proper was altered, and the cases of tabes or of spinal sclerosis followed by zoster also help to establish this fact clinically. Zoster usually occurs but once, still cases are on record of several relapses of this disease, and Kaposi[11] in particular reports a case in which, in a comparatively short time, zoster relapsed five times in the domain of the right cervico-brachial plexus, always in the same region; later, for the sixth time in the same patient, a lumbo-sacro-crural zoster occurred, likewise on the right side, while a seventh, eighth and ninth outbreak of the cervico-brachial zoster in this patient followed on the left half of the body.

Examples of zoster due to disease of the ganglionic system are more numerous than those dependent on affections of the spinal cord; hence the central nervous system is justly considered the starting-point of many similar cases. In frontal and cervical zoster, the brain and the medulla oblongata; in that occurring on the trunk, the cord may be designated the seat of the lesion. Less frequent are the cases in which zoster appears as a reflex neurosis. Dr. Jewel[12] observed a crural zoster which must be considered a sequel of a grave uterine disease, for with the remission of the latter, the zoster and the intense neuralgias receded.

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[1] Thèse de Paris, 1862, p. 156.

[2] Allgem. Wien. med. Zeitung, 1866, No. 48.

[3] "De l'herpès traumatique." Mémoires de la Société de Biologie, 1873.

[4] "Surgical Pathology." London, 1863, i., p. 43.

[5] L. c., p. 167.

[6] "Leçons sur les maladies du système nerveux." Paris, 1880, p. 29.

[7] Ophthalm. Hosp. Rep., Oct., 1866, p. 166.

[8] "Du Zona ophthalmique." Thèse de Paris, 1872.

[9] Comptes rendus de la Société de Biologie, 1870, p. 45.

[10] "Beiträge zur Kenntniss des Herpes Zoster." Charité-Annalen, 1863.

[11] Wien. med. Wochenschr., 1874, 1875–1877.

[12] Transactions of the Amer. Neurological Asso., New York, 1875.

In addition to neuralgia, we observe in zoster at times another sensory disturbance—anæsthesia dolorosa, *i. e.*, anæsthesia of the skin with simultaneous considerable painfulness. The explanation of this symptom is not difficult: As the cause of the pain lies in the sensory root of the spinal cord, a pathological process (exudation into the neurilemma, pressure of a new-formation, etc.) may intercept conductivity toward the periphery, thus inducing anæsthesia.

The nervous symptoms in zoster are not only of a sensory, but also of a motor nature, for paralytic conditions outlasting the exanthem occur at times. Broadbent[1] reported a case of a woman aged 74 years, who, without demonstrable cause, felt burning and stinging pains on the side of the right arm and nucha; shortly afterwards, zoster appeared, covering the shoulder, upper and fore-arm; a week later, there was partial paralysis of the arm which remained permanent. Duncan[2] observed complete paralysis of the right arm and leg, while the side of the face was free from paralysis, in a case of thoracic zoster in an old woman, after a neuralgia lasting several days and before the vesicular eruption broke out; the zoster and the incomplete hemiplegia persisted nearly three weeks and disappeared altogether.

That zoster may appear on both halves of the body cannot be denied at the present time.

Bärensprung divided zoster into nine varieties according to the locality; Hebra recognized only seven, viz.:

*a.* Zoster capillitii,
*b.* " faciei,
*c.* " nuchæ s. collaris,
*d.* " brachialis,
*e.* " pectoralis,
*f.* " abdominalis,
*g.* " femoralis.

*a. Zoster capillitii* is localized on the anterior and posterior portions of the scalp and extends along the twigs springing from the second branch of the trigeminus. This does not apply to all cases because, according to the above division, zoster ophthalmicus[3] comes under this head and the affected sensory twigs spring from the first branch, this being especially the case in zoster eruptions along the frontal and supra-orbital nerves. On the posterior scalp zoster extends along the occiput to the vertex, in the direction of the great occipital nerve.

*b. Zoster facialis.*—Hebra gives as the seat of this form the anastomoses of the facial nerve in the skin of the face. But the facial is a purely motor nerve, and as disturbances of motility are rarer than those of sensibility in this form of zoster and the neuralgias followed by herpetic eruptions, it is more appropriate to trace the pains to affection of the sensory, and not the motor fibres. But the sensory nerve-fibres in the face are derived from the trigeminus, and spread in the cheek, nose, lips, and chin;

[1] British Med. Journ., 1860.

[2] Journ. of Cutan. Medicine, London, 1868, p. 242.

[3] Zoster ophthalmicus has been more thoroughly studied not long ago, especially by Hutchinson, and the skin disease proper interpreted as the cause of some disturbances in the eye, such as photophobia, iritis, ulceration of the cornea, etc. Baumann, Jefferies, Weyss, and other ophthalmologists have repeatedly noticed the appearance of this form which at times causes, besides the above local symptoms, grave sequels like panophthalmitis, phlebitis in the globe with subsequent meningitis and a fatal issue.

hence the anastomoses of the seventh pair with the trigeminus are affected with neuralgia in facial zoster.

*c. Zoster nuchæ s. collaris.*—The vesicular eruption extends from the region of the cervical vertebræ either forward toward the clavicle, or upward toward the occiput and the auricle.

*d. Zoster brachialis.*—It extends usually from the first cervical and the first dorsal vertebra over the upper margin of the scapula, and spreads toward both the extensor and the flexor side of the upper arm. The groups of vesicles are not always in a continuous line, but broken by interspaces; the exanthem, however, may often be observed on the arm only, without affecting the skin over the vertebræ.

*e. Zoster pectoralis* is the name of the eruption springing from below the first dorsal vertebra; its territory embraces the skin of the thorax to the lumbar vertebræ. Its points of origin are assumed to be those vertebræ where the zoster arises, and its course, those intercostal spaces along which it extends. The intercostal nerves are usually implicated, and the concomitant neuralgias generally so violent as to lead to the suspicion of an incipient pleuritis if the vesicles have not yet appeared. Recently I observed a case of pectoral zoster in a woman aged fifty years; the groups of vesicles sprang from the spinal column and extended to the axillary region, spared the part of the skin covered by the arm, and then continued in the same intercostal space as far as the sternal region. This case was accompanied at the same time by the most violent neuralgia for six weeks, without cessation. At the present writing I have under treatment a similar case of pectoral zoster; it springs from the third dorsal vertebra, extends towards the left as far as the thorax, and covers nearly 10 cm. in breadth; some offshoots pass along the inner side of the upper arm; there has been absolutely no pain during the several weeks of its course.

*f. Zoster abdominalis.*—Its points of origin are the lumbar vertebræ, and the eruption spreads over the abdomen as far as the median line. The pain is often so considerable that the activity of the abdominal muscles is interfered with, and the patients, if constipated, are sometimes seized by attacks of pain during defecation.

*g. Zoster femoralis* takes origin from the buttocks, and extends along the thigh, partly in a peripheral direction from behind forward, or along the extremities as far as the popliteal space.

### *Etiology of Herpes.*

The explanation of the phenomena of vesicular eruptions is based on the fact that affections of the nerves are frequently followed by outbreaks of vesicular efflorescences.

But we must not go too far, and transform this experience gained at the bedside into a general doctrine, for not every neuralgia or disturbance of innervation, whether of central or peripheral origin, is connected with herpes; were this the case, the latter would be the most frequent of diseases. Nevertheless, the dependence of vesicle formation on these conditions has been so indisputably determined that this interrelation is one of the few more exact etiological facts we possess in dermatology.

With the various species of herpes we have given some points in the etiology and shall add merely a few short observations.

As regards facial herpes the explanation of its coincidence with or without pyrexial conditions is not sufficiently clear. Gerhardt[1] insisted years ago that the fibres of the

[1] Jenaer Zeitschrift f. Medicin, 1865, p. 345.

trigeminus are irritated by the fever. If the small arteries which run with the nerves through narrow bony canals contract during the cold stage, they dilate again in the following hot stage and press within the narrow canals on the nerve twigs which then lead to the vesicular eruption. This view has something taking in it, but it explains the process only in part, for herpes facialis is not always present in feverish conditions, appears with equal frequency without fever, is invariably painless, and is rarely bilateral.

In reference to herpes progenitalis we have already stated its dependence upon irritation in the genital apparatus, and as to herpes zoster, we can add nothing to what has been stated in the symptomatology.

*Prognosis.*

This is favorable; for excepting zoster, the various forms run a rapid course and disappear without leaving any sequelæ. Transition of zoster into other local affections may sometimes be observed; thus, in one case ending fatally, I saw zoster develop into general pemphigus.[1] Other sequels are sensory disturbances, and ulcerations within the zoster efflorescences. Patients suffering from zoster need not be restricted in any way; they may follow their avocations unless some functional disturbances occur. Should the disease be prolonged, we have usually to deal with the sequels of the affection (paralyses, sensory distubances).

*Treatment.*

The treatment of herpes is expectant and symptomatic. The former applies to the forms running their course without unpleasant symptoms; the latter to the alleviation of the grave concomitant conditions. It is only necessary in the painless forms of herpes—labialis, progenitalis, iris, and circinatus—to employ indifferent substances to protect the diseased surfaces against dirt, friction, etc. It is not advisable to hasten the drying of the vesicles by removing their contents by puncture; nor is it good practice to tear off the crusts. It is best to place thin layers of linen, coated with a pure fat, vaseline, or an indifferent ointment, upon the vesicles. If it be desired to use some medicament, the ointment may be mixed with carbonate of lead or oxide of zinc (1 : 10 to 15). In place of the ointment, dusting powders may also be employed, such as rice-starch flour, powdered soapstone, etc.; the latter are to be exclusively recommended for herpes iris and circinatus, while for the other forms of herpes the above-named ointments are more appropriate. For herpes progenitalis an indifferent or drying ointment of zinc or bismuth is to be recommended, because in doubtful cases this will best decide whether it is herpes or syphilis.

What has been stated applies likewise to herpes zoster, especially those cases which are free from attacks of pain, or other incidents. Physicians finally became convinced, after many tormenting and energetic modes of treatment, among which laxatives and venesections were not omitted, that the pain of the disease could be moderated merely by soothing and quieting remedies, and this led to the only rational method—the symptomatic treatment of zoster.

It is barely worthy of special mention that against this affection the whole array of narcotics has been employed in the form of ointments, plasters, cataplasms, and internally; and, according to the results, the several agents were credited with corresponding value as real remedies, not only formerly, but even to-day. We shall specify some of

[1] "Neuropathische Dermatonosen," p. 146.

them, to be tried if desired. Hebra advises a plaster spread on linen, such as empl. saponatum, diabotani, de Meliloto, to be the size of the diseased surface to be covered, the whole strewn with pulvis opii and fastened by means of a cloth or roller bandage, and the dressing changed once or twice within two or three days, until amelioration or cure results; besides, narcotics internally.

Wilson recommends large doses of quinine and iron, here and there even arsenic (although some physicians, like Hutchinson and others, have seen outbreaks of zoster appear in consequence of its use), also potassium iodide and narcotics. Among local applications have been recommended frictions with:

Oleum cadini, chloroformillæ, tr. aconiti, āā partes æquales; or, Tr. opii et Tr. aconiti, āā partes æquales; furthermore, ferri sesquichlor., 5 grams; alcohol. rectif., 30 grams; hydrarg. bichlor. corros., .05 grams; collodii, 5 grams; also frictions with ol. cajuputi, chloroform, etc.

Every physician who has some experience with cases of zoster will have been forced to make numerous trials, so as not to tire the patient, should some remedies give only temporary relief. All these measures cannot in the least take the place of the sedative method at our disposal in the form of narcotics. In intense neuralgias, morphine should be given in powder or hypodermically, also chloral hydrate, especially at night, so as to ward off the sleeplessness often caused by the neuralgia, at the same time bearing in mind the local treatment by cold applications, Hebra's plaster with opium, etc.

As auxiliaries it is well to recommend now and then baths and cold frictions, especially in cases in which narcotics cannot be borne for any length of time. Sequels in the shape of sensory and motor disturbances require electricity which often consumes much time and patience.

## MALUM PERFORANS PEDIS.

This is a disease caused by the influence of the trophic nerves; it begins as a cutaneous affection and leads to deeper lesions. This disease implies an ulcerative affection of the sole of the foot, beginning with a proliferation of the epithelium which sometimes springs from a thickening of the epidermis resembling a corn, sometimes from a corn subjected to constant pressure, at times from some other, usually traumatic influence.

In all cases the affection begins as a roundish ulceration as if punched out with an instrument; it is the consequence of a chronic inflammation which, if recognized in time and properly attended to, may close again; if not, it forms a disease which progressively extends in depth, with subsequent destruction of all the soft parts, the joints and bones; it often resists the most careful treatment, and in its further spread it not only becomes deeper, but also wider. The accompanying alterations on the common integument are very characteristic of the trophoneurotic disease. The alterations manifest themselves by excessive formation of epidermis, change of the nails, and profuse development of hair, both on the dorsal side of the foot and on the whole lower extremity. Together with these conditions we often find obvious pigmentations, erythemata and eczemas, and either diminished or increased perspiration. Owing to the local influences which seem to cause malum perforans, the affection was originally believed to be a local one; but the gravity of the disease, the duration of the ulceration, and the destruction of the soft parts and bones soon made it obvious that we must assume a more deep-seated malady, for the perforating ulcer of the foot has been often seen to arise after injuries to the spine, frequently in consequence of peripheral nervous affections; after section of the sciatic nerve in animals, ulcers have been noticed to form on the soles of the feet. Congelation

also furnishes an occasional cause of the disease, and Duplay[1] reports a case in which this cause incited a bilateral outbreak of the disease together with locomotor ataxia. The nervous disturbances preceding the ulceration are as characteristic of this affection as are the sequels. The former include frequent darting and boring pains, rheumatic affections, motor disturbances, etc.; subsequently may be developed general sequels caused by the disease of the nerves, such as local muscular atrophy, general progressive muscular atrophy and tabes.

Therefore, in these cases the character of the trophic disturbances is manifested by a series of symptoms which it would be hard to ascribe to other than nervous causes, especially where a more or less extensive anæsthesia is found in the neighborhood of the ulcer or in the affected extremity. The anæsthesia is a constant symptom of malum perforans, not merely in the region of the ulcer, but in the entire part supplied by the diseased nerve twigs; in some cases it is of so high a degree that the patients suffer from total loss of sensation, and at times the affected leg can be amputated without its being felt.

Histological examination of some nerve twigs showed also that they undergo considerable change in structure; besides the destruction of the myelin and the axis cylinder, a thickening of the neurilemma was sometimes found.[2] Hence the disease in its entire development and course is not only a nervous, but a trophoneurotic one, and is discussed in the description of the dermatonoses merely in so far as the cutaneous affection represents the initial stage of the perforating ulcer.

## DECUBITUS ACUTUS.

Ulcerations on the common integument are often observed as concomitants of grave diseases of the nervous system. They always occur after preceding erythemata, which, after a brief existence, are often followed by the formation of vesicles, from which is developed the subsequent destruction of the cutis and the subcutaneous tissue. As such complications usually occur on the lower portions of the horizontally extended body (shoulder, lumbar region, heel), and as they are generally observed in patients who are unable to make active motions, and as the skin, besides, is irritated at times by urine and fecal matters, it is easily understood that the ulcerations occurring in the sacral or anal region were considered processes due to pressure (bed-sores). Samuel,[3] however, has called attention to those ulcerations occurring with diseases of the brain and spinal cord, even after they have lasted but a short time or appearing suddenly in the course of the affection. He distinguished an acute and a chronic form, but his observations relative to the acute form became more generally known and accepted only through Charcot's thorough delineation.

*Decubitus acutus* is the essential form of the trophic disturbance. This affection may be observed in disease both of the brain and the spinal cord, and is a significant malady, for here it is not so easy as in the more gradually developing chronic bed-sores to bring the influence of local irritants to bear upon portions of the back and buttocks. This cutaneous gangrene is seen most frequently with cerebral apoplexy, whether due to external traumatic causes or associated with softening or hemorrhages. Charcot[4]

[1] Archiv génér. de Médecine, 1876, p. 346.

[2] Michaud, Lyon. médical, 1876, Janvier.

[3] "Die trophischen Nerven." Leipzig, 1868.

[4] "Leçons des maladies du système nerveux, etc." Paris, 1881, i., pp. 83 et seq.

first pointed out that, in hemiplegic conditions, the gangrene of the skin and the subsequent ulceration always occur on that side of the nates where the paralysis exists; therefore, in central apoplexies, on the side opposite to the apoplectic patch. Besides, in the latter, there is merely a unilateral ulceration; in apoplexy of the medulla, usually an ulceration extending over both sacral regions. The rapidity with which the ulceration occurs is most apt to make us suspect its neuropathic nature, for it is impossible to explain in any other way such suddenly developing, deep disturbances. In apoplexy of the medulla, the ulcer usually begins in the middle of the sacral region, and thence spreads symmetrically toward both sides; but both in this form and in circumscribed cerebral affections there is anæsthesia of the skin on the portions subject to crusting and ulceration. In patients suffering from this disease, even if the greatest care and attention be devoted to keep the paralyzed part as clean as possible and reduce the pressure to a minimum, the occurrence of bed-sores cannot be prevented.

Post-mortem examinations have in numerous cases demonstrated an inflammatory condition in the central nervous apparatus, but the point of localization could not be determined. Joffroy[1] concluded, from three cases in which the cutaneous gangrene existed on the nates and lesions were present in the posterior lobe and the optic thalamus, that disease of these portions of the brain is to be looked upon as the cause of trophic disturbances; others, however, found hemorrhages in the corpus striatum, anterior lobe, lateral convolution, etc., and have held that these were the cause of the bed-sores. Brown-Séquard concluded from the fact that acute bed-sore is often associated with incontinence of urine that the spinal cord was the starting-point of the affection, while Samuel had previously asserted that it was due to disease of the spinal ganglia. In view of these observations, it seems to be most correct to consider acute bed-sore a disease of the posterior columns of the cord, for in affections of the anterior columns, *e. g.*, progressive muscular atrophy and the essential paralysis of children, bed-sores never occur.

Trophoneurotic dermatitis occurs as a disease of the skin in which an erythema first appears on a circumscribed spot and leads to further inflammation, during which manifold nutritive disturbances set in. Among the latter are efflorescences of all kinds occurring after injuries, neuralgias, etc., and developing on an inflamed cutaneous surface. A peculiar form of this disturbance is glossy skin. In this affection the skin originally appears red, smooth, and glossy, and shows either a uniform or marbled erythema. Some physicians described the surface of the skin as being like varnish and so tense that all unevennesses and folds disappear. Later, the skin becomes thinner from atrophy of the underlying cellular tissue, and this process extends down to the muscular layers. As this disease chiefly attacks the extremities, the nails usually drop off after some time and the cutaneous glands perish.

This affection was first observed by Alexander Dänmark.[2] Subsequently, Paget,[3] Weir Mitchell,[4] and others have furnished a detailed description and have especially emphasized its complication with violent neuralgias which they termed causalgia (burning pains). It may be assumed that this affection is caused by a peculiar species of neuralgia. Moorhouse, Keen, and Mitchell have more thoroughly established the neuralgic theory; their conclusion is, that, in proportion to the nervous affection of an extremity, this peculiar atrophy of the skin associated with erythema becomes more intense and ex-

[1] Archives de Médecine, 1876, Janvier.

[2] Medical and Chirurgical Transactions, London, 1873, iv., p. 48.

[3] Medical Times, March 26th, 1864.

[4] "Des Lésions des Nerfs," Traduit de l'anglais par Dastre, p. 174.

tensive. Thus Mitchell asserts that, for instance, in injury of the ulnar nerve alone, the cutaneous affection extends only peripherally into the region of the skin supplied by this nerve; but if the lesion involves a larger plexus, not only the entire palm, but also the palmar surface of the fingers is attacked by the atrophic process, while the dorsal surface may remain intact.

At times glossy skin appears in the form of an erythema nodosum, the diseased and painful spots projecting above the surroundings in the shape of single nodes; in other cases the affection begins as a frost bite. Now and then there occur on the surface of glossy skin small excoriations or ruptures, the underlying skin pressing the tense epidermal layers apart. These additional complications increase the previously existing painfulness, unless a remission and final improvement of the affection have been secured by sedative treatment (electricity, cold water).

## IV. MOTOR DISTURBANCES.

Motor disturbances cause neither important diseases of the skin, nor serious nutritive changes. In the large number of elastic fibres terminating in its tissue, and in the numerous muscular trabeculæ embedded as smooth muscles both in the blood and lymph vessels, surrounding them as well as the efferent glandular ducts, the skin possesses many elements ministering to its contractility and elasticity. The contractility is caused by the nervous irritation acting on the muscular elements, and is either direct or reflex. Whenever an irritation affecting the cutaneous muscles acts in such a manner that the cutis is strongly excited, the muscular elements contract, the hair-follicles rise, the hairs become stiffer, approach each other, the surface acquires a wrinkled appearance, and a condition results which is called goose-flesh, cutis anserina. The most frequent cause of this alteration is cold, as during bathing in cold water or when the body at normal temperature is disrobed in a cool or cold room. The goose-flesh is less distinctly seen when the skin, after having been exposed to cold, is suddenly acted upon by intense heat, although it is even then perceptible. That the contraction of the skin is not sudden, but is gradually increasing and culminating, can be most clearly witnessed in the skin of the scrotum when contracting in consequence of either of the above irritations. There is no doubt that the contraction is effected in the same way on all parts of the body, but on those provided with small muscular elements this shrinkage is not as readily perceptible.

This motor disturbance is nearly always effected with a sensation of slight shivering (horripilation) which quite evidently is to be traced to a nervous cause. External irritations acting on the cutaneous surface are conducted to the centre which excites the finest nerve filaments and produces contraction. Rapid alternation of heat and cold most readily permits us to observe a succession of contraction and relaxation, and this alternation ceases only when there is a sort of balancing of the irritations. The correctness of this observation can be best verified by dipping a hand alternately into hot and cold water; the contractions of the cutaneous muscles continue until their activity is exhausted.

Besides heat and cold, sensory impressions are followed by contractions, and one need not belong to the category of nervous individuals to be attacked by cutis anserina in consequence of piercing tones, scratching of the nail on rough surfaces, etc. The same may be said of moral impressions; who does not shiver under the sudden influence of a great terror? On such occasions we do not generally observe whether "our flesh

creeps," but the feeling of shivering or terror does not pass without a like motor disturbance.

Among the causes of disease leading to the same alterations we might enumerate the pyrexial affections which, at times beginning with a more or less intense rigor, are followed by a general contraction of the cutaneous muscles. All the influences named act in a reflex manner, and are always rendered possible through the instrumentality of the central nervous system. Patients suffering from central affections, in whom the conduction from the centre to the periphery, or the reverse, is interrupted or diminished, show none of the above-named conditions.

Outside of the above-named conditions of contraction or spasm, the motor disturbances of the skin offer no important changes. In them, the muscular contraction is associated with that of the vessels, and subsequent displacement of the blood toward the interior of the body, and it is this sudden influence which causes the feeling of shivering; but when the molecular activity of the nerves becomes altered, we find altogether different sensations, the various forms of which we have already discussed in detail in treating of the disturbances of sensibility.

# ANOMALIES

IN THE

# GROWTH AND COLOR OF THE HAIR.

BY

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## ON EXPERIMENTS RELATIVE TO THE GENERAL ETIOLOGY OF ANOMALIES IN THE GROWTH OF THE HAIR.

Of acknowledged importance in the etiology of anomalies in the growth of hair are, besides the inherited tendency, general disturbances of nutrition.

The injurious influence of unsuitable alimentation on the growth of hair may be demonstrated by Magendie's experiment, according to which dogs fed exclusively on cheese, and others fed on hard-boiled eggs, became weak and emaciated and lost their hair.

In more recent times, there is a progressive increase in the domain of those forms of alopecia in the causation of which trophoneurotic influences are at work, although very little has been done experimentally in this direction.

A very noteworthy experimental observation has been recently published by Brown-Séquard. He noticed that the offspring of guinea-pigs in which he had divided the sciatic nerve became epileptic, and whenever the epilepsy began to improve, the hair fell from the region of the epileptogenic zone on the head and neck.

Furthermore, Eulenburg observed falling of the hair from the posterior region in rabbits after chemical irritation of the sciatic nerve.

In my experiments on rabbits, the operation was always done on the nerve of one side, but both limbs were depilated. In no case was there even a temporary cessation of hair production on the operated side; on the contrary, in some of the animals the growth of hair proceeded even more rapidly on this than on the healthy side. The irregular manner in which the subsequent growth took place was conspicuous. Within the depilated territory supplied by the injured nerve, there appeared, a short time after the

operation, a good-sized bunch of vigorous hairs, quite isolated at first; and at an exactly symmetrical spot on the other side, a similar bunch, but of smaller dimensions. Then new insular bunches of hair sprang up on both sides beside the former; they gradually increased in extent, and finally coalesced. While the law of bilateral symmetry obviously influenced the above-described reparative process, still the restitution on the uninjured side was slower, and completed later.

Schiff stated that on the side on which the sympathetic had been divided the hair grew more rapidly.

Sigmund Mayer made the following observation: Both ears of an adult rabbit were simultaneously depilated, then on the one side pieces were excised from the cervical sympathetic and the great auricular nerve. After one and one-half or two months, the hairs on the injured side had grown to the length of two mm., while on the healthy side a distinct streak of hair only had developed along the course of the median artery.

A parallel experiment made by myself proceeded as follows: After both ears of a rabbit aged eight months had been completely depilated, I resected a piece of the left cervical sympathetic and the left great auricular nerve. At the same time the ears of a second animal of the same litter and precisely similar configuration were depilated without subjecting it to any other operation. The cervical wound of the former animal healed by suppuration, and the rabbit emaciated considerably during the first period after the operation. Still after twelve days there showed themselves on both ears, especially their external margins, small, colored hairs; subsequently, the restitution of the capillary growth progressed rapidly and uniformly on both sides and was completed in about ten weeks. In the non-mutilated animal, the health of which had remained permanently good, only a delicate uncolored down could be found after twelve days, and the growth during the following weeks was likewise tardier than in the operated rabbit.

In most recent times, the experiment on animals made by Lassar and Bishop has been relied upon in order to aid in proving the infectiousness of "alopecia præmatura."

The combings of a man, aged 25 years, affected with this disease were cut fine and intimately mixed with vaseline; this ointment was transferred to the skin of healthy rabbits and guinea-pigs with good fur, and rubbed into the intact epidermis. In the course of the third week a decided loss of hair became perceptible on the anointed parts, and within another week portions of the skin the size of the palm of a hand were entirely bald. With the loss of hair there was very ample branny desquamation of the epidermis. The hairs and scales of the original test animals were then transferred to other animals; at the end of the second week, they were already quite bald on extensive surfaces.

In order to control these results, I made the following experiment: A mixture of about three parts of vaseline and one part of rancid olive oil was rubbed daily into the skin of the back of a vigorous full-grown rabbit with an excellent growth of hair. As early as the beginning of the second week of the experiment a distinct loss of hair was noticeable on the anointed parts of the animal which was kept isolated and well nourished; on the twelfth day its hairy covering on those spots was much reduced, the hairs still present were very loose. The skin was covered with fine scales, but otherwise quite unchanged. On the sixteenth day of the experiment, complete baldness over the anointed part which, however, soon regained its normal growth of hair after the inunctions were stopped.

## HYPERTRICHOSIS.

Most of the affections described under the name hypertrichosis offer not only a dermatological, but also an anthropological interest.

We classify the cases of unusual trichosis of man, *i. e.*, the occurrence of a beard in women or an abnormal growth of hair, whether in one or the other sex, spread over a more or less extensive portion of the body, as follows:

I. Hypertrichosis, probably due to heredity or a tendency acquired during intra-uterine life, hypertrichosis indoles hereditaria.

*a*. Hypertrichosis universalis.

1. The abnormal pilosis of the so-called "hairy men.
2. The general profuse pilosis of the male body.

*b*. Hypertrichosis localis.

1. The abnormal pilosis of a region the skin of which is apparently unchanged.
2. The abnormal pilosis on pigmented and thickened (hypertrophic) skin.

II. Abnormal pilosis due to pathological influences acting during extra-uterine life, hypertrichosis acquisita (hypertrichosis transitoria—Klebs).

1. By neurotic influences (hypertrichosis neurotica).
2. By cutaneous irritations (hypertrichosis irritativa).

It is to be emphasized that the baldness of those parts which normally are not even covered with lanugo, and are absolutely hairless (palms of hands and soles of feet, ungual phalanges of fingers and toes, inner preputial surface, glans penis, vermilion border of lips and upper eyelids), is not altered by hypertrichosis. The proliferation always develops from preformed hair-germs.

### I. *Hypertrichosis Indoles Hereditaria.*

As the best known specimens of homines pilosi, we enumerate: the East Indian

FIG. 26.—Andrian Jeftichjew, "the Russian Dog-Man."

family of Shwe-Maong, Andrian Jeftichjew, "the Russian dog-man" and his son Fedor,

and the "hairy family of Ambras." Common to these cases is a thick growth of hair extending over the whole body (excepting the parts mentioned), although by no means uniform throughout; naturally it is particularly conspicuous in the face, and there seems also most largely developed, thus giving to the type of the highest degree of hypertrichosis universalis s. hirsuties a decided animal cast.

Jeftichjew's portrait recalls the picture of a Scotch terrier. But the features of hairy men have also a certain resemblance to each other, which is caused by an essentially analogous arrangement of the hair.

We know from the labors of Eschricht[1] and Voigt[2] that the hairy investment with which the skin of the fœtus covers itself in the fifth and sixth months of intra-uterine life maintains quite definite directions ("hair currents and eddies"); from these same "seed furrows," in the course of which there are usually only moderate individual differences, springs also the hairy growth of the homines silvestres. This growth of hair, moreover, is nearly always described as soft, woolly, or silky, resembling wool rather than real hair. Hence Ecker has concluded that universal hypertrichosis should be considered an arrest of development, a persistence and further growth of the embryonal hairy coat.

The hereditary basis of the abnormality is generally demonstrable; in the family of Shwe-Maong, it was observed through the third generation. As a rule, we also find in hairy men congenital dental defects. This conjunction cannot be purely accidental, for we see it repeated in very different and widely separated regions. The grandfather of the Burmese "hairy family" entirely lacked the twenty molars, of the four canines he had but one, nor were there any alveolar processes for the absent teeth. The daughter of the latter is likewise without molars and canines. Statements as to the tooth-formation of her children are not on record. A similar defect is also shown by the Russian hairy man. His upper jaw is quite toothless, excepting the left canine, but the teeth of the lower jaw are complete; at the time of the examination of his son Fedor, then three years old, the upper jaw was toothless, and there were but four incisors in the inferior maxilla.

The simultaneous occurrence of irregularities in both systems, the hair and the teeth, odontogenetically derived unitedly from the corneous layer, has been repeatedly observed. Danz,[3] Sedgwick,[4] and others report cases of congenital baldness with inherited complete or partial defect of the teeth; hence the dental defect cannot be looked upon as compensatory to the superabundant growth of hair.

Generally strong pilosis of the male body, developed not uniformly, but chiefly over certain parts of the skin, as the face, chest, back, dorsal surface of the extremities, is hereditary in some families, and presents, as it were, a slighter degree of hirsuties congenita. For these cases likewise the law is valid that the abnormal pilosis exactly follows the direction of Eschricht-Voigt's lines.

Anomalous trichosis confined to isolated parts of the skin is found in the occurrence of a beard in women. With Bartels we might here distinguish three degrees: First, the so-called "Bärtchen" (little beard) of young women, in fact merely a somewhat stronger growth of the lanugo which is always more largely developed in the situation of the beard than elsewhere—the upper lip, the masseter region, at times the chin. In the second

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[1] Müller's Arch. f. Anat., Phys., etc., Jahrg. 1837, pp. 37 et seq.

Denkschr. d. Wien. Acad. d. Wissensch. (Math.-naturw. Kl.), Bd. 13, 1857.

[3] B. Eble, l. c., p. 245.

[4] Cited by Darwin, "Variiren d. Thiere u. Pflanzen," Bd. 2, p. 434. Stuttgart, 1868.

degree, hair likewise sprouts from the regions typical of the male sex, but those affected are generally beyond the climacteric period and have previously shown no very pronounced tendency to the development of a beard; many of them incline also in otherways (deep voice, large bones) toward the virile habit. The several hairs are generally thick, bristle-like, but not very close together. Finally the third degree is the rarest: actual beards occur in women of every age, of course by preference again in such as are past the bloom of youth. In this category belong, among others, the well-known case related by Beigel, of a Swiss woman aged twenty, in the fifth month of pregnancy, who presented herself in 1852, with a goatee and moustache four inches in length, at a London hospital, in order to obtain a certificate as to her sex.

As "heterogeny of trichosis" would have to be enumerated in this connection the premature development of hair associated with sexual precocity which always appears in the places typical of the respective sex—in girls only on the genitals, in boys, besides, on the chin, the upper lip and the cheeks, often also the chest. As an example we cite Beigel's case of a child aged six years, whose pudenda resembled those of a woman of twenty, both respecting their general development and their hairy covering.

Circumscribed hypertrichosis on an apparently unchanged portion of the skin, which normally is not provided with dense growth of hair in either sex and at any time ("heterotopy of trichosis"—Bartels), has been observed especially in the sacral and lumbar region, in the latter several times complicated with spina bifida.

In Ornstein's case of sacral trichosis we notice that the direction of the hairs corresponds to the neighborhood of Voigt's "coccygeal cross."[1] The latter is only displaced slightly upward, which is not of unusual occurrence.[2]

A hereditary family peculiarity is quite notable at times in the shape of a hair proliferation met with in the face of older men, combined with increased density of the hairs of the beard and eyebrows. At the external ear, on the bridge of the nose, within the nostrils and the auditory canal, bunches of thick, chiefly gray or white hairs spring forth —a process probably parallel with the development of a beard in women beyond the climacteric.

We now come to the abnormal trichosis on pigmented, or pigmented and thickened skin, an illustration of which is found in the adjacent figure.

Dr. Schulz, Regimental Surgeon, to whom I am indebted for the photograph and notes of this case, first observed the patient in 1878.

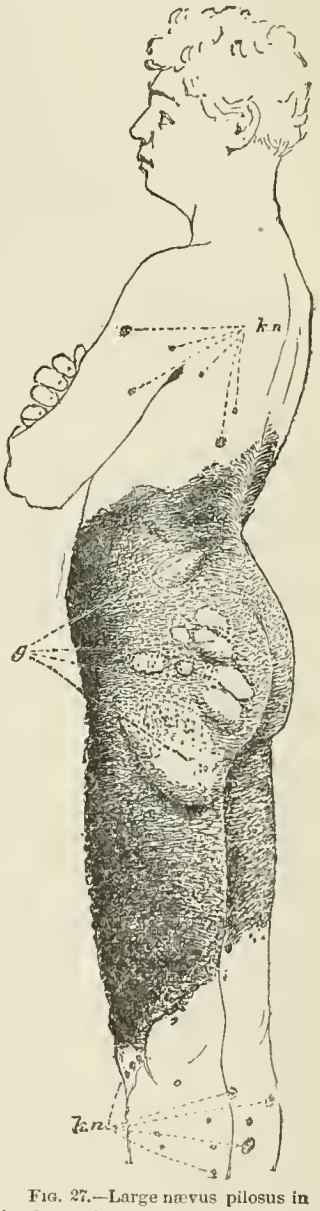


FIG. 27.—Large nævus pilosus in the shape of bathing-tights. Within it, several benign tumors (Fibroma molluscum) *g*. External to it also numerous smaller nævi, *k.n.*, *k.n.*

[1] Voigt, l. c., p. 13, and Plate I., Fig. 4.

[2] Comp. A. Ecker, "Der Steisshaarwirbel," etc. Arch. f. Anthropol., Bd. 12 (1880), p. 132.

This individual, named Balke, stated that he was born with the large nævus spreading over the upper part of the thighs and the lower portion of the trunk, in shape like bathing-tights and resembling the pelt of an animal; the same was true of the smaller hairy spots (*k.n.*) and the larger and smaller tumors (*g*). Subsequently the altered portions of the skin had gradually become somewhat larger. Hereditary predisposition could not be determined. The skin of the large hairy nævus, as well as that of the smaller ones, is stated by Dr. Schulz to have been in the main thickened, in part uneven, verrucose, in color from very light to intensely dark brown; the consistence of the larger mammiform and smaller tumors, soft, doughy-elastic. The integument of the tumors was paler, smoother, and much less hairy than the surroundings and did not firmly adhere to the tumors. The tumors being situated in the subcutaneous cellular tissue, could also be displaced on the underlying muscles. The photographs were rather inferior in technical execution; but they permitted me to ascertain definitely that, whenever any positive arrangement of the short (at most three centimetres long, according to Dr. Schulz), dark and curly hair was evident in the picture, it agreed exactly with Eschricht-Voigt's fœtal lines of direction.

In the Balke case, therefore, there was a combination of a congenital very large nævus pilosus and a number of smaller ones with congenital tumors, which may be classed as benign, *i. e.*, fibroma molluscum (Virchow). The same combination has been observed by Walther.[1] As regards the at first sight so very striking extent of the large nævus, a search through the literature brought to light several parallel cases.

1. The Indian woman Orangutang presented at the office of the *Lancet* (*The Lancet*, l. c.). 2, The Milan case mentioned by Hebra (l. c., p. 30). 3. H. Hildebrandt's case No. 1 (l. c.). 4. Ruggieri's case (l. c.). Here belongs also 5, the case described by Jablokoff and J. Klein, of a girl, who died at the age of six and a half months of tuberculosis. 6. The case figured in Hebra's atlas[2] over the title "carcinoma melanodes" would exactly correspond to the Balke case, were it not that the limit of the darkly pigmented nodular skin falls higher on the right thigh than the left, about corresponding to the distribution of the lumbo-inguinal nerve.[3]

All the above-mentioned hairy moles have in common: the bilaterally symmetrical arrangement; in nearly every one either the upper or the lower limit coincides with the course of the cutaneous nerves.

That larger hairy moles may also develop unilaterally in the region of certain nerves is shown by a nævus occupying the domain of the second branch of the trigeminus, figured by Fr. A. v. Ammon (l. c.).

The quality of the skin in the nævi under consideration is generally described as varying in intensity of pigmentation (gray to black), rarely as smooth, chiefly as rough, somewhat thickened, verrucose, nodular. Smaller warty nævi pilosi, frequent concomitants of every kind of hereditary hypertrichosis, are often found beside the large moles; a definite arrangement of these small nævi is generally not clearly recognizable. In Hildebrandt's first case (see above), in midst of the hairy, darkly discolored surface, insular portions of the skin appear more greatly thickened and more densely covered with hair.

Like the other kinds of hypertrichosis, nævi crinosi likewise are congenital or develop in the first years of life on an hereditary basis; in them, too, the arrangement of the proliferated hair corresponds to the lines of direction of the embyonal hairy investiture. If this circumstance is not everywhere equally evident in the illustrations, this is probably in part owing to the fact that the real arrangement of short and curly hair is

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[1] Ph. Fr. Walther, "Ueber die angeborenen Fetthautgeschwülste." Landshut, 1814, in Rayer, l. c., p. 282.

[2] Plate X., No. 10.

[3] Comp. Schwalbe, "Lehrb. d. Neurologie." Erlangen, 1881, p. 979.

often difficult of recognition. By applying moisture along the "nap" of the hair, the confusion may be cleared up.

*Etiology and Anatomy.*—We possess but little positive knowledge respecting the etiology of hypertrichosis, outside of hereditary predisposition. The attempt to explain it as atavism according to the doctrine of descent, lacks for the present every solid basis.

Virchow was inclined to seek a "neuristic" explanation, and he called particular attention to the fact that in the "wild men of the woods" the most essential alterations lie in the region of the trigeminus.

It has been already indicated that the more extensive proliferation of hair on thickened, or pigmented, or thickened and pigmented skin follows the course of certain nerves more closely than the other categories of hypertrichosis belonging here.

But whatever may be the basis on which the anomalies belonging to our first class are developed, we have to deal with a hypertrophic condition of the hair matrix. Considered from this point of view, there is then merely a difference in degree in the hypertrichosis on a cutaneous surface which is thickened, verrucose, or even partially interspersed with fibroma molluscum; for the latter is in the main nothing but a hyperplasia of the skin and the subcutaneous cellular tissue.

NOTE.—Most modern authors, following Virchow (l. c., p. 339), sharply separate hypertrichosis on thickened, or thickened and pigmented, skin from the proliferation of hair on the unchanged cutis. In our opinion, however, these anomalies are genetically equivalent: but we shall refer to some of the literature which shows that there are manifold analogies and transitions between the congenital alterations of the skin now under discussion. 1. Lombroso's case (*Giorn. ital. d. mal. ven.*, etc., 1871, ref. in Viertjschr. f. D. u. S., 1871, p. 294). Microcephalic girl, hypertrichosis universalis, changes in the inferior maxilla and the teeth. The skin is defined as dark (30–54 of Broca's scale). 2. Virchow's description of Fedor Jeftichjew. Besides the hypertrichosis in the face and the adjoining parts, insular patches of more intense pilosis on the back and arms. 3. Gerhardt, *Jahrb. f. Kinderheilk.*, 1871 (iv., 3, pp. 270 et seq.), case 1. Neuropathic cutaneous papillomata on the right side of the trunk, right arm and left half of the face. In the left half of the mouth several teeth are small and irregular. 4. Same author, ibid., case 2. Congenital warty, light to dark brown excrescences, intermingled with spots of the same color. 5. Fibroma molluscum with pigmented cutaneous surface, but without hypertrichosis has been observed many times. Especially interesting is the second case of Dyce Duckworth (ref. in Schmidt's *Jahrb.*, Bd. 167, p. 183)—besides the tumors covered with dark skin, pigment spots on the back, shoulders, and legs—and particularly the masterly description of v. Recklinghausen's first case ("Multiple Fibrome der Haut," Berlin, 1882): Multiple soft fibromas of the external skin and subcutaneous tissue, multiple fibromatous neuromata of the cutaneous nerves, the trunks and branches of the nerves of the extremities, the sacral plexuses, the vagi and the abdominal sympathetic, the frontal branches of the trigeminus, some muscular twigs of the obturator nerve, etc. On the skin, innumerable lentil-sized pigment spots, a larger one on the left buttock: also, intense, diffuse brown coloration along the external side of the thighs, around the external pudenda, in the sacral and inguinal fold, and in the skin on the top of the shoulder.

A detailed autopsy is on record of the Jablokoff-Klein case (see above).

The cause of death was tuberculosis. In the corpus striatum and cerebellum were three small, blackish-brown, sharply defined nodes. Two slate-colored spots in the pons Varolii and one of the temporal convolutions. From their histological character, Klein interprets the nodes in the brain as sarcomata, probably of metastatic origin. The seat of the pigment accumulation in the skin was the stratum mucosum and the papillary layer; here, as in the melanotic cerebral nodes, the pigment was found partly in irregularly scattered round cells, partly and chiefly in regularly arranged spindle-cells which occupied the adventitial spaces of the transitional vessels and the capillaries. The spinal ganglia were unchanged.

## II. *Hypertrichosis Acquisita* (*s. Transitoria*).

Abnormal trichosis from pathological influences acting during extra-uterine life is described:

1. As dependent on disturbances within the nervous system—hypertrichosis neurotica. Thus, Erb[1] and Schiefferdecker[2] reported abnormal increase in the growth of hair in some cases of spinal paralysis. The latter also observed manifold trophic disturbances occurring after gunshot wounds of peripheral nerves, and among these almost constantly increased growth of hair. The local hypertrichosis was present not only below, but also above the gun-shot wound. Leyden considered the hypertrophy of the epidermoidal formations a compensation for the atrophy of the muscular tissue. Fischer's[3] experience is somewhat different. After nerve lesions he found, as a rule, that the hair at first proliferated profusely, but fell out subsequently.

2. Cases of heterotopic pilosis after cutaneous irritations—hypertrichosis irritativa—are not very rare. The literature, however, certainly requires critical sifting. As examples of hypertrichosis irritativa we enumerate Rayer's observation of proliferation of hair on parts which had been irritated for months by the application of vesicants, and Kaposi's[4] report of the occurrence of long, woolly hairs on the wrist-joint of a puerpera after a daily inunction of gray ointment of mercury continued for three weeks.

NOTE.—It is customary to enumerate among the various kinds of hypertrichosis an excessive growth of hair in places even normally covered with close, vigorous, longer hair (scalp, region of the beard). I have left this group of cases out of consideration, because it is altogether too much a matter of subjective estimation to decide where the limit of the normal ceases and the abnormal begins.

*Treatment.*—Only some kinds of local trichosis form the object of medical treatment.

Smaller hairy moles are best removed by excision. For the local hypertrichosis on the unchanged skin (here the development of beard-hair in women comes specially under consideration) we possess palliative and radical methods of treatment. Among the former belong: shaving, pulling the hair with tweezers, and removal by weak caustic pastes. As none of these methods removes the follicular parts of the hair-shafts, the hair remnants showing through the skin of brunettes cause the formerly hairy spot to appear as a dark patch after palliative treatment. This defect of the method is especially conspicuous after simple shaving. Epilation with tweezers, except in the case of very small spots, is quite troublesome, and besides somewhat painful.[5]

The employment of medicinal depilatories is relatively most useful. On examining the number of chemicals recommended we become convinced that it is especially lime which has been in favor of old[6] for depilation, and a careful study of the formulæ teaches that nearly all of them aim at the formation of calcium sulphydrate. This substance is prepared most simply by the introduction of sulphuretted hydrogen into calcium hydrate. It forms a grayish-green mass, the disagreeable odor of which is difficult to cover even by

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[1] His "Handbuch," Bd. xi., 2.

[2] Loc. cit., p. 163.

[3] Berlin. klin. Wochenschr., 1871, p. 145.

[4] Hebra-Kaposi, l. c., p. 48.

[5] I have been unable to confirm the statement that after long-continued pulling the latter growth of hair gradually becomes more deficient in pigment.

[6] Comp. Galenus, De compos. pharmac., Lib. 1, Cap. 4, cited by Eble.

the addition of deodorants (tonca beans, orris root, oil of lemon). The paste (to be preserved in a well-closed vessel) is spread with a horn knife to a thickness of one line, and, according to the irritability of the skin, is allowed to act for five to ten minutes. Then scraping off of the rapidly drying paste with the edge of the horn knife, cleansing of the skin with lukewarm water. inunction with some vaseline, cold cream, or zinc ointment into the spot.

American physicians regard the electrolytic method as an effectual radical treatment. To the negative pole of a galvanic battery is fastened a very thin needle—the one used by Fox is modelled after the flexible steel points used by dentists for the extraction of the pulp—and inserted into the follicle of the hair to be removed. Strength of the current, ten to sixteen elements of a zinc-carbon battery. The positive (sponge) electrode is held by the patient in the palm of the hand. Ten to twenty seconds are required for loosening the hair in the follicle. In sittings lasting three-quarters of an hour, thirty to fifty hairs are removed. The painfulness of the process is very slight, the reaction on the skin generally quite trifling. Only exceptionally, it is said, punctiform, barely visible cicatrices are produced.

Bulkley's method is more simple of execution. It is based on inflammation excited in the follicle after thorough removal of the hair. The hair is grasped with tweezers and at the same time a small, sharp-pointed, triangular needle with cutting edges is inserted into the follicle by the side of the hair. While a light pull is given on the hair, the needle is pressed in, advanced to a depth corresponding to the bottom of the follicle and then turned several times around its axis.

With the like object, others insert into the follicles needles heated by fire or the galvano-cautery, or moistened with caustic fluid (for instance, carbolic acid).

Not without reason, Kaposi[1] points out how problematical it is to reach the papilla of the hair, by the destruction of which alone the effect is produced, owing to the oblique and quite incalculable direction of the several follicles. G. H. Fox admits that, on an average, thirty to fifty per cent of the hairs so treated grow again and make a repetition of the procedure necessary.

## ATROPHY AND DYSTROPHY OF THE HAIR.

The maintenance of a normal, equally dense growth of hair depends upon the fact that the hairs, falling after the lapse of their typical duration of life, are continually replaced by others formed anew; there is a constant balance between expenditure and receipt, between loss and restitution. Every disturbance of the relation to the detriment of the after-growth leads to defective growth, to alopecia.

An older nomenclature distinguished: 1. *Calvities*—the baldness of the aged due to natural causes; 2. *Defluvium capillorum*—a pretty uniform loss of hair occurring over the whole head or even over the entire body, in consequence of pyrexial and constitutional diseases; 3. *Alopecia*—loss of hair from local causes and on limited parts of the skin.

### ALOPECIA CONGENITA.

Alopecia may be congenital and may affect the entire skin—alopecia universalis congenita—or may be confined to isolated patches—alopecia localis (s. arcata) congenita.

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[1] "Pathol. u. Therap. d. Hautkrankh.," p. 524. Vienna and Leipzig, 1880.

### *a. Alopecia Universalis Congenita.*

In many cases of congenital baldness, there is not a permanent arrest of formation, but merely delayed perforation of the hair through the epidermis. In children born bald, the scalp becomes covered with lanugo between the first and second year of life, and toward the end of the second year, or still later, is replaced by hair of normal thickness.

Such a case is at present under my observation. In this two-year-old girl, otherwise normal in every respect, the head is now only slightly covered with downy hair.

Luce made the following observation: A girl aged eight years had been born quite bald. In the sixth month, numerous small elevations on the scalp had shown themselves; the first hairs were noticed in the sixth year. When Luce saw the girl, he ascertained that there were a few blackish-gray hairs of normal thickness and a length of one and a half centimetres, besides the numerous downy hairs. The scalp showed firm conical nodules of unchanged color with a central black point. When the top of these nodules was lifted with a needle under a magnifying glass, a black mass was seen underneath, which could be recognized as a curled-up hair.[1] But the hairs in question showed in regular alternation thin and spindle-shaped thickened places.

Danz saw two adult persons who had never had either hair or teeth. Rayer also states that he has observed several cases of congenital permanent alopecia and reports the details in a patient aged 32 years.

Schede described two cases in the children of a peasant woman, a boy of thirteen years and a girl of six months; both had been born quite bald, and no hair had developed later. In addition there were neither eyebrows nor eye-lashes, and nowhere could a trace of lanugo be discovered. Otherwise both children appeared well-formed and of a development corresponding to their age. The parents were healthy and had a full growth of hair; this was true of two other children.

### *b. Alopecia Localis (s. Areata) Congenita.*

If the congenital baldness is confined to a limited portion of the skin, it seems that restitution of the growth of hair is never to be expected.

I have seen two cases of this kind:

Case I.[2] is of interest from the fact that the congenital bald spot on the vertex "eddy" was followed in the fifth year of life by others, one slightly below the former, the other on top of the left parietal bone. The patient was a delicate, scrofulous boy without further developmental anomaly.

Case II. occurred in a vigorous boy aged fourteen. The relatives noticed in the first years of life a small bald spot a few centimetres above the right ear, at the junction of the temporal and parietal regions. The circumference of the oval congenital area is said to have gradually enlarged. At present the length of the bald spot is about three centimetres; its greatest width, one and a half centimetres. The otherwise unchanged scalp is covered here with a few longer and a number of downy hairs. Another anomaly in the boy's family is noteworthy: in our patient as well as in his father and two brothers, the two central upper incisors are several millimetres longer than the other teeth.

Nothing is known respecting the pathogenesis of alopecia congenita. As in hypertrichosis, abnormalities of the teeth have often been observed, and deformities of the nails more rarely. The not infrequent occurrence of congenital alopecia in brothers and sisters points to hereditary influences.

*Anatomy.*—Schede found, on a piece of the scalp excised from the older of the children

[1] Comp. F. Hildebrant's "Handb. d. Anatomie." Herausgeg. von Weber. Fourth ed., p. 204. Brunswick, 1830. The above-described condition is generally termed lichen pilaris, after Willan.

[2] Already mentioned, l. c., p. 33.

with congenital baldness (see above) under his observation, the sebaceous glands well developed, and opening directly on the skin by a free channel. Rudiments of hair existed in the deeper layers of the cutis in the shape of short, straight or slightly convoluted tubules without perceptible internal cavity. In their whole structure (externally, long, narrow cylindrical cells with rod-shaped nuclei; internally, small roundish or polygonal cells) they corresponded to the external root-sheath. These tubuli were largely changed into microscopic atheromata by a central bulbous conglomeration of flattened epidermis cells.

Jones and Aitkens found that the cutis of the scalp in their case was replaced by a cord-like areolar tissue with interspersed fat-cells and accumulations of granules. Between them were altered follicles. Here and there indications of papillæ. The epidermis was atrophic.

### ALOPECIA SYMPTOMATICA.

(Loss of hair from local causes and in circumscribed spots.)

All more important alterations of the hairy skin must necessarily lead to disturbances in the growth of the hair. Whether the alopecia of this character implicate only single hairs as in acne, or a large part of the capillitium as occasionally in erysipelas, it is always strictly confined to the limits of the affected portion of the skin.

Alopecia symptomatica may occur as a concomitant of parakeratoses; but, for obvious anatomical reasons, it is met with more particularly in inflammatory processes, in superficial or deep-seated, circumscribed or diffuse, infectious or non-infectious, acute or chronic forms of dermatitis (for instance, acne, eczema, erysipelas, variola, most of the mycoses, in papular, pustular, and ulcerous syphilides, etc.). Compression and tension of the hairy skin, *e. g.*, by tumors, are a not infrequent cause of regional loss of hair.

Like its development, the prognosis of symptomatic alopecia is dependent upon the character and the intensity of the primary cutaneous affection. In all destructive diseases ending in the formation of cicatrices, the consecutive loss of hair is permanent and incurable. In the treatment, too, the indications depend on the nature of the primary cutaneous affection.

### ALOPECIA SENILIS AND PRÆSENILIS.

It is often stated that in advanced age, not alone the hair of the head, but also that of other parts of the body, the beard, the genitals, and the eyebrows, diminishes. In persons of very advanced age, we have not rarely seen the hair of these parts grow denser, and we believe that any considerable loss of hair in these parts can by no means be demonstrated as of frequent occurrence.

As has been stated in a previous section, a proliferation of hair on normally smooth portions of the skin develops not rarely in both sexes in advanced age; with good reason, therefore, we might speak of an occasionally increased tendency to the production of hair. Experience teaches, however, that such a disposition is never displayed on the scalp; on the contrary, the loss of the hair of the head in the aged is one of the most common signs of senile retrogression, whether the rest of the body is thickly or lightly covered with hair.

The baldness of the aged, as a rule preceded by a whitening of the hair, is more frequent in men than in women; it begins on a small spot, according to Pincus, almost always on the top of the vertex, and spreads very slowly forward, then sideways and backward. But in the small region, which is seized at once, lanugo soon takes the place of

the more vigorous hairs, and in a few months it becomes quite bald. Then it takes comparatively a long time until downy hairs grow at a place closely adjoining the former; but whenever this takes place, the process attacks the new region with equal intensity.

In not a few persons gradual baldness occurs early, generally on an hereditary basis. This condition is aptly termed alopecia præsenilis. Common to both varieties is the above-described progress of the affection; but in alopecia præsenilis the increase of the absolute daily loss of hair is less than in alopecia senilis; in the former, moreover, the intermediate lanugo-formation occurs only on a small part of the vertex, but not on the temples and the occiput (Pincus).

The skin bared by alopecia senilis or præsenilis seems thinned, somewhat tense, but easily displaceable on the underlying bone. If the individuals are otherwise well nourished, the hairless surface may show a certain fatty lustre. The follicular openings, unless the baldness is of very long standing, are still clearly recognizable and here and there covered with delicate downy hairs.

*Anatomy.*—Senile atrophy of the scalp is preceded by alterations in the blood-vessels. A fibrous endarteritis narrows the lumen of the cutaneous arteries; the ample capillary network, which otherwise spreads through the connective-tissue portions of the skin and especially surrounds also the hair-follicles, partially perishes. This primary involution of the blood-vessels is followed by an atrophy comprising all the cutaneous layers; the atrophy manifests itself in the epithelial portions by a thinning of the cell-layer, in the connective tissue by a contraction corresponding to the insufficient supply of nutrient plasma. The hair-follicles shrink considerably, but their openings remain comparatively wide, and their upper parts generally present the appearance of a funnel diminishing downward; they are filled either with loose horny masses or contain the finest downy hairs. More rarely we find at the bottom of the otherwise empty sac convolutions of pigmented roundish nuclei—an abortive attempt at hair formation. The cutaneous muscles are usually preserved, appear rather broadened, and finely granular from fatty degeneration. Perhaps the direction of their course has become generally more horizontal, more nearly parallel to the level of the surface of the skin. The glandular organs of the skin show the greatest power of resistance. At a time when the above-described symptoms are already completely developed, we find the sebaceous glands unchanged in size and structure. Nor does the process exert any material influence on the number and extent of the sweat-glands. For the present it may remain undecided what importance should be ascribed to an accumulation of lymphoid cells, which we have frequently found especially around the convoluted glands. Finally it must be emphasized that any considerable alteration in the nerves of the bald skin has not hitherto been demonstrated.

According to Pincus,[1] the anatomical examination of the cutis in advanced alopecia præsenilis gives essentially the same results as in alopecia pityrodes (comp. below), only that the thinning of the median layer of the cutis is still greater.

All experienced authors acknowledge that therapeutic measures offer no hope of success.

### ALOPECIA PITYRODES (CAPILLITII AND UNIVERSALIS).

#### *a. Alopecia Pityrodes Capillitii.*

*Symptoms and Course.*—One of the most frequent affections of the scalp, the most

[1] L. c, No. 3.

common cause of premature baldness is *alopecia pityrodes* (Pincus) s. furfuracea (Kaposi). Its course of development proceeds about as follows:

In an individual of fifteen years or over, rarely before the commencement of puberty, there appears at first an insignificant, later gradually increasing desquamation of the scalp which affects the entire head pretty uniformly. After the lapse of five to seven years, as a rule, the patient notices a greater daily loss of hair than he had previously experienced. Female patients become aware in this stage already of the large number of shorter hairs, which rebelliously project from the middle of the plaits, causing a thinning of their lower portions. In men the scalp at first appears as dense as formerly, after two to four or six years, however, is thinned in some parts, especially the vertex and the forehead. The absolute number of the falling hairs now is materially increased; among the combings are found even in men a very considerable quantity of "pointed hairs," *i. e.*, such as may complete their typical course of life, owing to the short length of the hair worn by men, without falling a prey to the barber's shears (Pincus).

NOTE.—During the normal nutrition of the scalp the pointed hairs, having a comparatively short duration of life, are furnished only by the margins of the scalp, and occur merely isolated between the hairs destined for longer growth. (For further details compare the chapter: Anatomy of the Skin.)

Besides, some of the hairs already show the downy character; a great many have their transverse diameter much reduced. Thereby the onset of the second stage of the malady is marked. In abnormally rapid change of hair, every after-growing hair on the median and partly also on the anterior part of the head, much less pronouncedly on the lateral and posterior portions, is shorter and thinner than its predecessor produced by the same follicle, and in this way all the hairs of the diseased places are gradually changed into lanugo. Meanwhile, the pityriasis has decreased apace and thereafter is but very slight in those regions of the head where the greater part of the hair already shows the character of the downy hair. In the further course, baldness ensues in the median part of the head, owing to the steady deterioration of the substitute for the falling hair; in the temporal regions and the occiput alopecia pityrodes does not lead to an equally high degree of alteration in hair production; here final baldness is produced only by senile alopecia.

The first stage of alopecia pityrodes, therefore, is characterized essentially by progressive decrease of the typical longitudinal growth of the single hair of the head, conjoined with a pityriasis extending over the entire scalp, but particularly pronounced in the median portion. The characteristic factor of the second stage is a decrease of the transverse diameter of the single hair. Even in the beginning of the affection it may be at the same time demonstrated that the after-growth of hair has often a considerably shorter term of life than the preceding.

It must furthermore be emphasized that women are much more rarely affected with alopecia pityrodes than men.

The first symptom, the pityriasis capitis, is in many cases obvious even at a distance, by a glance at the coat collar of the patient. White, dry, flour-like scales are detached from the scalp by the slightest motion, and fall on the clothes. The hair, too, is covered with these scales, and so amply as to appear as if dusted over. Frequently, the dandruff is of a more greasy quality and is then of a dark-gray color, because the atmospheric dust is intimately mingled with it. Combing does not clear the scalp from the adhering scales, this requires a thorough washing with soap; then the desquamation soon forms afresh.

Ordinarily we may, from the intensity of the cutaneous desquamation, deduce a like intensity of the abnormal rapidity of the hair change, and the intensity of the pityriasis on the various regions of the head proceeds pari passu with the degree of the hair disease.

Examination of the scales in question has shown that they consist largely (three-fifths of their weight—Pincus) of morbidly altered, "abnormally firm" products of secretion of the sebaceous glands.

Kaposi (l. c.) sees a reason, in this fact especially, for maintaining the seborrhœic character of the pityriasis capitis which by Hebra has been termed seborrhœa sicca. However, as here we have by no means only an increase of the sebum, but the production of "grease drying upon the surface of the skin" (Hebra, "Lehrb.," 2d ed., Vol. I., p. 90), the technical term chosen by Hebra might easily give rise to an erroneous conception of the process.

While formerly it was assumed that alopecia began only after the pityriasis had existed for years, the simultaneous occurrence of both processes has been determined by Pincus.

As regards the development of alopecia, it should be mentioned that the alteration of the typical longitudinal growth at the start seizes all the hair of the head, but after a few years it proceeds more quickly in the median part of the head than in the other regions, the hairs of which, as may be most distinctly seen in women, permanently maintain an average length of eleven to sixteen centimetres (four and one-half to six and one-half inches).[1] The clearing of the scalp in the second stage of the disease first appears in the shape of a strip, two to four centimetres broad, which begins about two centimetres behind the anterior margin of the growth of hair; often also at the same time at the vertex eddy, so that there are at first two clearings, later bald spots, corresponding to these localities (Kaposi). At the anterior margin of the hairy growth, the median part above the glabella resists the disease much longer than the external parts situated above the frontal eminences. Much more rarely the loss of hair first manifests itself at the frontal edge; then, too, there is generally a second centre at the vertex eddy.

The aspect of the scalp after removal of the scales shows no deviation, but we can determine, often even in the beginning of the disease, a firmer attachment, a diminished plicability in the median part of the head.

Many persons suffering from alopecia pityrodes state that they feel a "prickling" headache, conjoined with a certain sensation of heat, lasting for hours, or even days, in the region of the vertex. The sensibility of the diseased scalp is intact.

These are the main points of the morbid picture described by Pincus. In a few particulars, our experience differs from that of the author named. For while, according to the latter,[2] the perspiration at no time shows any perceptible alteration, we have heard numerous patients complain of increased disposition of the scalp to perspire, and at times convinced ourselves of the correctness of these statements.

*Diagnosis.*—Alopecia pityrodes can be diagnosticated as soon as the above-mentioned firmer attachment of the scalp shows itself together with increased desquamation. Even without the presence of the former symptom, chronic pityriasis capitis always gives rise to the suspicion of commencing alopecia, for experience teaches that, at least in the majority of cases, the hair becomes thinner after the pityriasis has existed for several years. In order to ascertain the beginning of alopecia early, Pincus advises the collection of the falling hair on four successive days by means of combing with a fine comb,

[1] Ibid.

[2] Pincus, l. c., 2, p. 333.

and the determination of the proportion of the pointed hairs to the total loss. Should this amount to one in eight, with an average length of the hair of thirteen centimetres, or one in ten, with that of five to eight centimetres, it is abnormal. A moderate quantity of absolute loss of hair need cause no disquietude, inasmuch as the limits thereof seem to be rather extensive even in the normal state. Respecting the decrease of the typical length of the female hairs, which are all pointed, we can easily convince ourselves by measuring the lost ones.

In the differential diagnosis from alopecia senilis, we can utilize the observation that senile alopecia sets in with rapid increase of the absolute loss of hair, an equally rapid spread of the loss of pointed hair, and a rapid diminution in the transverse diameter of many hairs.[1] In alopecia præsenilis, there is an absence of the pityriasis, and the clearing of the scalp ensues gradually from a small centre, not as in alopecia pityrodes, rather uniformly over the whole median part of the head.

*Prognosis.*—The prognosis is most unfavorable where there is a hereditary tendency, but even here treatment can be made effective in the first stage. In the second stage, in general, we must renounce the hope of seeing the thinned hairs grow thicker again; but frequently it is possible to keep in their present condition those hairs which have lost little or nothing of their transverse diameter. Of importance for the prognosis, moreover, is the age at which the first symptoms present themselves; the earlier after puberty this has been the case, the more rapid as a rule is the course. A criterion of the intensity is furnished in the first stage by the degree of the pityriasis and the proportion of the pointed hairs to the total loss; in the second stage, by the number of falling, short, fine, lanugo-like hairs, continually increasing with the rapid progress of the alopecia.

*Anatomy.*—Pincus compared the skin of the top of the vertex where the disease had farthest advanced with the still normally coated skin of the occiput of persons dead of intercurrent diseases, and found the transverse diameter of the epidermis layer equal over both parts; but on the diseased parts the layer of the cutis tissue proper, between epidermis and subcutaneous cellular tissue, was thinned, the degree of thinning being proportioned to the stage of the hair affection. The transverse diameter of the fatty layer was usually greater on the affected than the healthy places, and the fatty layer of the former regularly showed an ample fibrous framework explaining the tight attachment observed clinically. Pincus particularly emphasizes that he could observe no pathological alterations in the vessels.

It should be added that microscopic examination of hairs epilated during the development of alopecia pityrodes from the morbid regions shows nothing characteristic. Most of these hairs display the same alterations which occur during the normal change of hair on those which are about to fall. Especially noticeable is the dry root deficient in nuclei and pigment; it has either the form of a narrow solid club becoming pointed below, or else it consists of ray-like diverging fibres—prolongations of the cortical substance of the hair shaft. As improvement sets in, more nearly spherical, at least well-rounded full roots are encountered, such as correspond to hairs which have for a greater length of time remained in the bed-hair stage. Increased brittleness of the shaft is largely observable, as in all processes leading to atrophy of the hair.[2]

*Etiology.*—The most important etiological factor is inherited tendency which may manifest itself in otherwise perfectly healthy persons. Next in order are numerous pro-

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[1] Pincus, l. c., 2, p. 342.

[2] Comp. v. Bärensprung: "Die Hautkrankheiten," p. 112. Erlangen, 1859.

cesses causing impairment of bodily vigor. Affections which exceptionally are succeeded by a rapid, copious, but usually well-recovered defluvium capillorum—for instance, syphilis, a grave typhoid fever, an irregular puerperium, mental disease with prevailing melancholia—are much more frequently followed by the onset of an alopecia pityrodes capillitii distinguished by a rapid transition into the second stage. The hair affection supervening in the later stages of tuberculosis, carcinosis, and other processes leading to general cachexia, has all the characters of alopecia pityrodes. In the female sex, the disease now under conderation frequently forms a sequel of simple chlorosis.

The view of Hebra-Kaposi that a chronic seborrhœa is always the primary condition and that the alopecia occurs only secondarily, has in our opinion been disproved by Pincus. Both processes are parallel effects of the same cause; the branny desquamation of the scalp, the symptom of an "atrophy of cornification," is based on abnormal constitution or local nutrient conditions in the same way as the nutritive anomaly of the hair formation, the analogue of horn production (Auspitz).

Owing to the conformity with districts of peripheral nerve expansions generally exhibited by the baldness in the male, some authors[1] took occasion to suggest that the loss of hair both in alopecia senilis and in the various forms of premature alopecia might be preceded by the death of peripheral nerve twigs. For the present this attempt at explanation lacks every anatomical basis.

Lassar and Bishop (l. c.) have lately asserted, basing their opinion on experiments with animals, that "alopecia præmatura" could be caused by contagion.

*Treatment.*—The therapeutic measures formerly in use were directed solely against that stage of the disease in which a clearing of the scalp already indicated the impending termination in baldness. Among the number of medicaments[2] recommended, we can distinguish three categories; either a medication was attempted which should act alteratively upon the deeper layers of the cutis, by strong irritation of the upper layers (caustic soaps, etc.); or one which was to have an astringent and, vaguely, roborant effect on the entire skin (tannin, quinine); or, finally, irritating drugs were employed which had the reputation of possessing as pecific influence on the development of hair (veratrine, tincture of cantharides).

But, as has been stated above, it is precisely the treatment of the first stage of the disease which offers the best prospect of success. Unfortunately, professional advise is rarely sought for chronic pityriasis capitis. For this stage Pincus believes only those agents to be appropriate which excite a very mild irritation on the skin ; he had the most favorable results by the employment of sodium bicarbonate.

The concentration of the mixture must be specially determined for every patient ; it is diluted until, when rubbed for several minutes into the forehead of the patient, it produces neither reddening nor even slight burning. The dose may be gradually increased. In order to keep the solution in long and intimate contact with the scalp, it is necessary to pour it over the latter in the evening, and during the night apply a compress well saturated with the fluid, protected by a cap of impervious cloth (gutta-percha tissue, oiled silk).

A disagreeable incidental effect of sodium bicarbonate is that the color of the hair acquires an admixture of dirty reddish-brown which takes place especially early and with greatest intensity in the case of dark hair.

Martineau employs a five-per-cent watery solution of chloral hydrate. Two tablespoonfuls are warmed and then rubbed into the scalp with a sponge. The desquamation

[1] Comp., for instance, O. Simon, "Localization d. Hautkrankh.," p. 87, Berlin, 1873.

[2] Comp. Pincus, l. c., 4, p. 310.

can likewise be removed by ablutions with weak solutions of corrosive sublimate (Sol. Hydrarg. bichlor. corros., 0.5 : 150 ; Glycerini, Spirit. Colon., āā 75 Lassar).

In the second stage Pincus succeeded in keeping the affection in abeyance for a space of several years by two remedies, viz., tannin and oil of savin.

The tannin ointments employed contained 5 grams to 30 grams of fat ; two or three times a week during the use of this salve the head was cleansed with a dense soft brush dipped in warm soap-suds. Still more effective than tannin was oil of savin (in alcoholic solution, 5-30 drops in 30 grams), but during its employment such serious drawbacks manifested themselves (increased brittleness of the hair, dirty grayish or brownish discoloration of the epidermis, but especially a penetrating odor, headache, nausea, etc.) that it could only exceptionally be utilized.

In more recent times a method of treatment has been introduced which fulfils numerous indications in both stages of alopecia pityrodes. Its effectiveness rests on the following three factors: 1. The scales and fat are thoroughly removed from the scalp. 2. The circulation of blood and the activity of the cutaneous muscles is stimulated. 3. Pure fat is brought to the skin from without. Hereby are indicated at the same time the three parts into which the method of treatment is divided. A flannel rag moistened with lukewarm water is saturated with a sufficient quantity of spirituous soap (for instance, a solution of good glycerin soap in spirit of wine, equal parts ; or a filtered solution of two parts of potash soap in one part of alcohol—spiritus saponat. kalin. Hebræ), and the scalp thoroughly washed by means of this rag. Then an irrigator, provided with a small spout, is suspended about one metre above the patient's head, and first one-half litre of lukewarm, then one to one and a half litres of cold water are allowed to fall upon the head. The head is carefully dried with a rough towel, and finally—only after several hours if the hair be still somewhat dense—the scalp is thoroughly saturated with pure olive oil.

According to the degree of pityriasis, the procedure should be employed every day, or we may order the whole process only for two or three days in the week, for the other days a curtailed modification restricted to irrigation with succeeding oiling. The patient's attention is to be called to the fact that the loss of hair at first is apparently increased, as the already loosened hairs are removed completely in the first days of treatment.

In order to exert a more vigorous cutaneous irritation in the second stage of the disease, it will suffice to add to the spirituous glycerin soap, table salt to saturation—about four per cent are dissolved—or to rub the scalp previous to the oiling with a rag dipped in salt water.

NOTE.—The favorable influence of sodium chloride on the growth of hair has been demonstrated experimentally by Pincus.[1]

Of other medications recently recommended the pilocarpine treatment should first be mentioned.

The action of muriate of pilocarpine on the growth of hair was accidentally discovered by Schmitz, who saw new hairs develop on the bald spot in two persons to whom some subcutaneous injections of pilocarpine had been given for other reasons. Schueller[2] confirmed Schmitz's statements from experiments on animals ; and Pick gained the conviction, from the improvement obtained in ten cases of alopecia pityrodes, that, " where the disease has not reached a high degree and does not rest on hereditary basis, the pilocarpine treatment is capable of producing permanent results."

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[1] L. c., No. 4, p. 308.

[2] Arch. f. experiment. Pathologie, etc., Bd. xi., pp. 88 and 89. 1879.

The remedy is best employed in the form of subcutaneous injections twice a week. The dose for each is about 0.005 to 0.010 gram. For internal use 0.005 to 0.010 gram is ordered once or twice daily (Pick).

The pomade introduced into the market by Demarson-Chatelet & Cie., of Paris, under the name of "La Philodermine, pommade antipelluculaire," has acquired a certain reputation in lay circles. The chemical examination made at my instigation by Mr. Gaebler showed that sulphur was the chief ingredient. Krause's analysis showed that it also contained small quantities of iron oxide and magnesia.

About six years ago, in a case of alopecia pityrodes under Unna's observation, considerable improvement was secured by the employment of this pomade. Unna has since then employed an ordinary sulphur ointment, for instance:

| | |
|---|---|
| Sulph. præcip., | 3 grams. |
| Adipis (ungt. pomadin.), | 30 grams. |

M. ft. pomade,

in all cases of so-called pityriasis capitis, *i. e.*, alopecia pityrodes incipiens, coming under his care, and gained the conviction "that all cases were greatly improved in a short time, and completely cured when its use was continued for a long time."

Unna has the hair parted every evening first in a sagittal, then in a coronal direction at intervals of about one centimetre, and the sulphur ointment lightly rubbed in along these lines. Every third or fourth evening the head is previously cleansed of the remnants of the old ointment. As soon as the desquamation decreases markedly, differing, according to the intensity of the case, from the second day to at most a week, the inunction is performed every other evening only. Should the results continue equally good, only two weekly inunctions are given in the third and fourth weeks, then for one to two months but one per week, thus gradually stopping entirely.

By the use of this sulphur inunction treatment of Unna's, cure of alopecia pityrodes is said to be secured not only in the first stage, but even when considerable thinning of the hair has already occurred.

Finally it should be pointed out that in treating alopecia pityrodes, any other indications derived from the general constitution of the body must be most carefully met.

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In Kaposi's "Pathologie und Therapie der Hautkrankheiten"[1] we find the statement that at times "the alopecia progressing with seborrhœa" simultaneously or exclusively affects the eyebrows or the beard. Such cases I have also repeatedly seen.

In one of my colleagues suffering from alopecia pityrodes of an hereditary character from his twentieth year, there was present from the beginning to the present day (patient is now thirty years old, the clearing of the central portion of the scalp is already quite distinct, no adequate treatment has ever been employed) a very great desquamation of fatty scales. When in 1874 he allowed his beard to grow, he noticed that a flaking off similar to that of the scalp took place in the side whiskers and the goatee. After the beard was shaved off, the pityriasis barbæ diminished.

Probably these cases represent a transition to the rare disease for which I would propose the term

*b. Alopecia Pityrodes Universalis.*

The development of this form of alopecia is exceedingly violent. Setting in with and accompanied by abundant desquamation of fatty scales, there ensues within a very

[1] Vienna, 1880, p. 568.

short time a material thinning of the hair of the scalp. Synchronously or subsequently the same symptoms occur on other parts; when the disease is at its height, the body is deprived of the greater part of its hair. Inasmuch as definite centres may now be clearly recognized where a much greater loss of hair has taken place than elsewhere, the group of symptoms presents a strong resemblance to the malignant form of alopecia areata (comp. below). More thorough examination, however, shows that even the parts most affected are in no stage of the disease completely bald, but covered with fine, colorless, lanugo-like hairs, or that at least rudiments of hair are present in the follicles; furthermore the transition to the vigorous hair of the periphery is not sudden, but gradual. Those regions of the scalp for which the ordinary form of alopecia pityrodes exhibits a predilection are, it seems, attacked also by alopecia pityrodes universalis soonest and with special violence. As opposed to alopecia areata, the skin in alopecia pityrodes universalis is not thinned, not displaceable on the underlying tissue with abnormal facility, and is folded with greater difficulty; it has a fatty feel, is covered with scales as a rule, and the openings of the hair-follicles can be easily recognized.

With reference to etiology, debilitating influences seem to be of importance. The following case shows that even the almost total defluvium capillorum exceptionally developing after exhausting general diseases may present the character of alopecia pityrodes universalis sketched above.

Dg., silver-worker, of vigorous build, acquired a hard chancre in November, 1879. Was put on a course of inunctions from December, 1879, to January, 1880. Patient states that quite suddenly, between the 27th and 30th December of 1881, a quantity of hair fell in bunches out of his full, reddish beard; soon after, the scalp began to be very rapidly depilated. When the patient first presented himself to me on the 21st of February, 1881, he stated that he had lost much flesh within the last few weeks and felt weak. The character of the alopecia, which had attacked also the genital and axillary hairs, completely corresponded to the highest degree of alopecia pityrodes universalis. On parts of the skin which appeared bald, the mouths of the follicles were partly studded with lanugo, partly with dark points, which were difficult to interpret microscopically; wherever the latter condition obtained, a comedo-like body could be squeezed by lateral pressure out of the hair-sac, which, under the microscope, proved to be a rudiment of hair. Examination further showed the cause of a pronounced fetor ex ore to be the presence of a discolored deposit on the gums (the patient was largely employed in gilding, and thus forced to inhale mercurial fumes). Treatment: Saline baths, rinsing of the mouth with potassium chlorate solution, inhalation of salt-water vapors from an apparatus; roborant diet. After a few months (beginning of May) the hair commenced to grow again; in July the growth was already completly restored, and has continued normal to the present time. The new-growth on the scalp is altogether dark blond, while the former hair was reddish. The moustache preserved its previous reddish blond color, but the chin and side whiskers had reappeared in lighter (blond) color than before and continued so.

The results of the microscopic examination of epilated hairs give as little information in alopecia pityrodes universalis about the cause of the atrophy as they do in most other forms of alopecia.

Of the rarer alterations, the hair rudiments found in the above-detailed case should be first described. The degenerated hair-shaft, as represented in Fig. 3, consisted chiefly of soft, multinuclear, strongly pigmented tissue, similar to that found normally only in the immediate neighborhood of the bulb of freshly vegetating hair. In the portion of the rudiment next to the surface of the skin the cells seemed to have been transformed into cortical scales, but their coherence was abnormally loose, presenting a brush-like appearance. The inappropriate or insufficient nutriment supplied to the matrix, therefore, had not caused a complete interruption of the hair production, but merely led to

an incomplete cornification of the cellular elements obviously furnished in insufficient number by the papilla, and to a defective secretion of cement substance.

In another case of alopecia pityrodes universalis, the finest lanugo-like hairs, taken from the spot most affected by the disease, showed themselves almost without exception provided with a well-developed medullary cylinder. The occiput of the patient in question was still densely covered with apparently vigorous hairs. When some of these were withdrawn with tweezers, which succeeded with the lightest traction, almost the whole of the root-sheath followed, not rarely also the homogeneous membrane of the hair-sac. On the external root-sheath the symptoms of pathological cornification could often be perceived.[1]


FIG. 28.—Hair rudiment from the scalp of a man suffering from alopecia pityrodes universalis. *Hr.*, hair rudiment (described in the text). *Bt.*, part of the internal investment of the hair-follicle. 240 diam.

Alopecia pityrodes universalis has a generally good prognosis. *Treatment.*—Saline baths, roborant medication and diet; besides, in the case of strong desquamation of the scalp, ablutions with spirituous soaps, chloral hydrate, or weak solutions of corrosive sublimate, douches.

### ALOPECIA SIMPLEX.

Cases of loss of hair occur exceptionally which otherwise resemble alopecia pityrodes capillitii, but lack the morbid desquamation of the epidermis and the increased secretion of qualitatively altered masses of sebum. For these cases we accept the above title chosen by Pincus.

### ALOPECIA AREATA.

*Symptoms and Course.*—By the term alopecia areata we understand that affection of the hairy skin in which there occurs first a loosening, then a total loss of hair on chiefly roundish, rather sharply demarcated, gradually peripherally enlarging and finally confluent patches, without the skin in the mean time showing any obvious alterations.

In the milder (benign) cases the loss of hair is confined to isolated portions of the scalp or beard; in the graver (malignant) cases, it may extend to all parts of the skin covered with hair.

Alopecia areata is relatively rare. It attacks preferably youthful persons, but may develop also in those of riper age. There are no statistics relative to the frequency of occurrence in the two sexes; according to the writer's experience, patchy baldness appears to be more frequent in the male sex than in the female.

The initial stage of the disease is accompanied in many cases by a distinct influence on the general health, manifesting itself by headache, loss of appetite, lassitude, and emaciation. Headache is complained of with special frequency and, if the affection is unilateral, has its seat at times mainly in the corresponding half of the head. Various paræsthesiæ occasionally appear as precursors and likewise remain confined to the affected area and its immediate surroundings (itching, evanescent sensations of heat often associated with annoying prickling, pain with the slightest pull on the hair, etc.).

[1] See further details in Monatshefte f. pract. Dermatol., 1882, No. 4.

The affected skin is free from vesicles, crusts, or scales. At first it is almost completely devoid of hair; the few perhaps still remaining differ neither in circumference nor other aspects from the surrounding, apparently intact hairs of the marginal zone. By careful inspection we often discover isolated stumps of hair broken off close above the level of the skin. The mouths of the hair-follicles in the beginning are still distinct, but gradually collapse more and more, and at the height of the malignant form they appear as the most minute punctiform depressions which can be found with difficulty by the unaided eye. In the grave cases the skin is pale and anæmic from the start, and reddens but slightly on irritation. Moreover, it is thinned—a symptom which becomes more and more unmistakable with the progress of the disease—its panniculus adiposus is defectively developed, and it may be displaced on its bony base with abnormal facility, and frequently appears somewhat depressed.[1]

In all of my patients, I found the cutaneous sensibility of the diseased skin intact, at times even increased.

The scalp at the periphery of the spots—which are usually roundish, at times rather oval or irregular, and expand always circumferentially, never radially—as long as the disease has not come to a standstill, is already pretty well thinned, and for some distance, corresponding to the rapidity of the development, covered with hairs sticking but loosely in their follicles. But these hairs have still a perfectly normal diameter, and their cohesion is but very slightly diminished.

It has already been intimated that in the benign form the higher degrees of the above-described cutaneous atrophy on the whole are more rarely observed. Nor does the complete baldness here continue long; as a rule the loss is soon followed by an after-

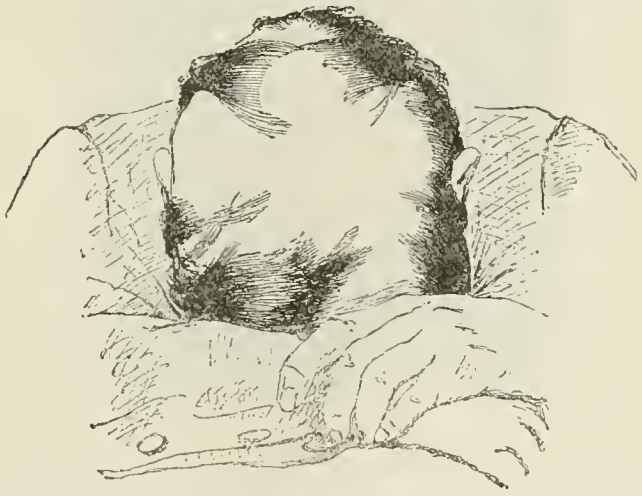

Fig. 29.—Alopecia areata. Form of baldness due to the confluence of several areas. The drawing is that of a man of thirty-five who became affected about the end of 1880, put himself under treatment on January 19th, 1881, and was discharged cured in September, 1882.

growth of very short, thin, and faintly colored hairs. In the course of time these "fillers" are replaced by more substantial hairs of the same quality as the original; at times, however, this takes place only after the new-formed, loosely inserted lanugo had

[1] According to Hutchinson (l. c.), the last-named symptom becomes more marked when the surrounding healthy skin is shaved.

reached a certain length and then had likewise fallen. Such abortive attempts at regeneration may even be repeated several times in the course of months or years. It may happen, too, that while the growth of hair on the portions first affected is definitely increasing, the hairs of other regions are beginning to fall, and such an interrupted progress permits us to demonstrate different stages of the affection.

In the malignant form the course proceeds as follows: At the very beginning several centres of loss of hair are observed on the scalp or in the region of the beard (more frequently the former); they steadily enlarge without any intercurrent attempts at restitution. At this period of the development the above-mentioned general symptoms set in. The continual progress of the bald spots gradually consumes the remaining ridges of hair which separate the several areas, thus producing the characteristic dumb-bell and trefoil forms of baldness represented in Fig. 29. However, the loss of hair is not confined to the scalp or beard, but may successively or simultaneously affect both, and in time but few small groups of vigorous hair can still be found. At the acme of the disease, the eye lashes and brows, the axillæ and the genitals, at times even the hairs of the extremities are involved in the affection. Many patients complain of frequent chills.

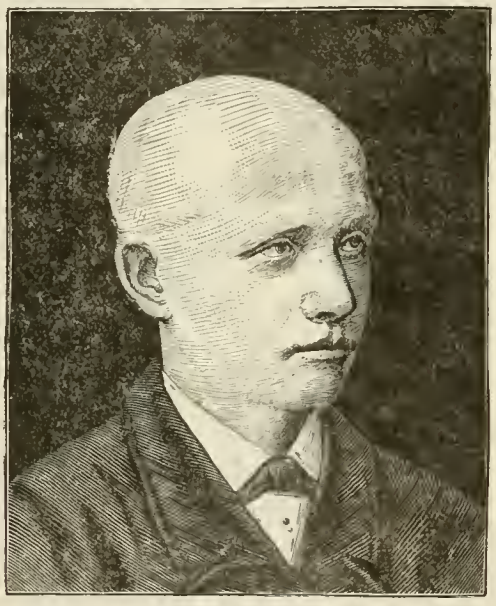

FIG. 30.—Total baldness in a boy of seventeen years (Rudolf Woelk, described in Volkmann's Sammlung klin. Vorträge, No. 120, pp. 7 et seq.), caused by alopecia areata.

The scanty eye lashes and brows give to the eye a strikingly free, bold expression. Hereby, as well as by the delicate skin of the face and the strong prominence of the facial bones due to the defective development of the subcutaneous fat, is produced the peculiar type which gives to these patients a certain family resemblance. The patients are perpetually reminded of their bodily defect by the unwelcome attention they attract among strangers, and it cannot surprise us that their frame of mind is greatly depressed.

The recovery in these grave cases proceeds very gradually. Close to the few groups of vigorous hairs still present there spring up, anywhere in the midst of the bald spots

or those covered with delicate lanugo, new small islands of closely aggregated, firmly embedded, normally pigmented and normally thick hair. In the course of time, more of these islands develop. A gradual enlargement of these oases leads to the confluence of their lateral borders, whole ridges of hair appearing anew on the bald surfaces; at first they present themselves in approximately arc-like segments, which again extending toward one another unite into almost circular forms. Where the several curves have a considerable extent, new bridges of hair branch off from them at an obtuse angle, and in turn surround, in an analogous manner, surfaces of smaller diameter within the large bald patches. The same process takes place simultaneously on several portions of the depilated skin, and by continual broadening of the marginal ridges from the periphery toward the centre the circumference of the bald or lanugo-covered areas by the encroachment of those provided with more vigorous hairs becomes ever narrower until recovery is finally complete. During this stage of the recovery, the limp quality of the morbid skin is gradually lost.

*Diagnosis.*—The losses of hair due to trichomycosis circinata are largely confounded with the patchy baldness from alopecia areata.

It may be admitted that after the inflammatory process caused by the vegetable parasites has run its course, a form of circumscribed baldness may exceptionally develop in mycosis circinata which resembles that due to the benign alopecia areata. In such a case the history of its development, or perhaps the presence of other portions of the skin affected by the disease in a less advanced stage, will confirm the diagnosis. As long as the fungous vegetation continues, trichomycosis tonsurans s. circinata is again well characterized, independent of the microscopic appearances, by the dermatitic symptoms and the general fracture of the hair close above the level of the skin. The frequent mistakes can be understood only if we bear in mind the unfortunate confusion still existing in the nomenclature.

The differential diagnosis between alopecia pityrodes universalis and the malignant form of alopecia areata has been discussed above.

*Prognosis.*—Recovery may take place even in the gravest cases. For instance, the patient by the name of Sohf described by me (l. c.)[1]—he had suffered from symptoms of the malignant form for about sixteen years—writes me that he regained his full growth of hair about two years ago, and I have just received information from Dr. Freymuth, of Danzig, that even our patient Diekert[2] again rejoices in an almost normal growth of hair for some months past. The latter, now 48 years old, had been nearly entirely bald in consequence of alopecia areata since childhood. Still for those suffering from the malignant form restitution cannot be prognosticated with absolute certainty, and at all events a considerable space of time, usually several years, always elapses until the hair is completely recovered.

The cases to be classed as benign usually recover after several months, at most after a year; very few of them have a tendency to relapse. In the beginning it is necessary to be very reserved regarding the prognosis, for only the subsequent course will show whether the cases will assume the malignant character or not. The former is more probable should the general health be greatly implicated, the circumference of the bald spots rapidly increase without intermittent lanugo formation, and the signs of cutaneous atrophy set in early.

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[1] Volkmann's Samml., No. 120, p. 10.

[2] Ibid., pp. 6 and 7.

*Anatomy.*—E. Wagner and H. Schultze had the opportunity of examining small excised portions of the diseased skin. The former found the affected skin thinned, but otherwise normal. H. Schultze examined a small portion of the cutis from the margin of an area the size of a dime on his own scalp which had recently begun to become bald. The microscope showed (besides the signs of premature cornification of the hairs) no further alteration.

The presence of vegetable parasites in the hairs of porrigo decalvans was first announced by Gruby (1843); and he was succeeded by others. But nearly all later investigators positively denied the existence of Gruby's Microsporon Audouini, and it had begun to be looked upon as a myth, when our present fungi-loving epoch helped Gruby's doctrine to a new life, though in a changed form.

Gruby describes the diseased hair as surrounded by a true fungous sheath, partly consisting of threads of mycelium, partly of spores. Malassez's "champignon de la pelade" takes root only in the superficial layers of the epidermis; it is totally absent in the hair-follicles. Eichhorst encountered his fungus-spores exclusively in the portions corresponding to the upper two-thirds of the follicle, chiefly between the hair and the internal root-sheath; from there only a few isolated ones had migrated outward. Malassez, like Eichhorst, saw only spores, no threads of mycelium; but while the former finds his champignon quite unlike the Microsporon furfur, Eichhorst thinks the spores found in alopecia areata so extremely similar to Microsporon furfur that he would assume their very probable complete identity, or at least a near relationship. H. Buchner, whose results, like those of E[illegible]horst, were drawn from a single case, reports some organisms belonging to the schizomycetes [illegible]nich were not at once recognizable, but to be found only after cultivation: granules with tw[illegible] filiform processes. Finally, G. Thin claims to have discovered a "bacterium decalvans," o[illegible]und or more oblong shape, having its seat between the hair-shaft and cuticula or else betweeu t[illegible] shaft and the internal root-sheath.[1]

I have never been able to convince myself of the presence of vegetable parasites.

In my paper "Ueber Herpes tonsurans und Area Celsi," I stated that all the described alterations may occur also in the nutritive disturbances of the hair due to other causes. Since then, H. Schultze has essentially confirmed the correctness of my communications, and his demonstrations strengthen our conviction that the examination of the epilated hairs in alopecia areata furnishes nothing characteristic of this disease.

*Etiology.*—It was chiefly two attempts at explanation which served as the starting-point to the debate over the pathogenesis of alopecia areata. We shall briefly designate them as the parasitic and the neurotic theories.

The former has but a very limited number of adherents at present. Even assuming the parasites to have been actually present in the reported cases, the proof is still to be furnished that this was not an accidental condition, but that the parasites really were the cause of the disease. Furthermore, the clinical morbid picture undeniably exhibits material deviations from the symptoms common to the recognized dermato-mycoses. No accumulation of detached flakes of epidermis, no formation of crusts, vesicles, pustules, or even nodules; exceedingly few cases,[2] the cause of which could perhaps be traced to infection; nowhere the report of a successful experimental inoculation. The aspect of the skin in the last-affected peripheral portions not to be differentiated from that in the first-attacked central points, and the recovery does not commence at these, but at the periphery.

Furthermore, the parasitic theory is unable to explain the fact that in a large num-

[1] Judging from the drawing and description, Thin's bacterium decalvans bears a striking resemblance to the smallest air-bubbles frequently present in this locality in particular.

[2] Ziemssen, l. c.

ber of cases the initial stage of the disease is accompanied by violent headache and other general symptoms, nor does it throw light on the pallor and thinning of the affected skin demonstrable in the graver cases. Even in the sense of a schizomycotic theory, the symptoms remain without any analogy. No one would think of placing erysipelas, variola, or lepra in the same line with alopecia areata as regards symptoms and course. Relative to the statements of Buchner and Thin, moreover, a dictum of C. v. Nægeli is of importance, namely, that the schizomycetes cannot take root and increase on the external skin, owing to the lack of sufficient moisture.[1]

Von Bærensprung's neurotic theory is the prevailing one at present.

The proof of "inhibited innervation" (v. Bærensprung) was thought to be found, 1st, "in the alterated sensibility" of the diseased portions of the skin (comp., however, p. 421); 2d, in the nervous symptoms occurring during the stage of development; 3d, in the analogy of alopecia areata with certain cases in which consecutive loss of hair appeared in other diseases, probably of a neurotic origin; 4th, in the heredity occasionally demonstrable; 5th, finally, reference was made to the experiments of Steinrueck, discussed in the first section of the present chapter.

Hutchinson was the first to notice that alopecia areata showed a preference for individuals with a weakened constitution. Von Bærensprung acknowledged the correctness of this observation and sought to bring it into connection with his theory by supposing that the "inhibited nerve influence" assumed by him manifested itself more frequently in connection with certain constitutional disturbances than in otherwise healthy persons. I have shown[2] that more or less serious objections can be raised against the neurotic theory, and that this is still without any solid foundation.

Should we, in lieu of a better, still adhere to the neurotic theory, it seems to be more correct to attribute the disease to the vaso-motor, instead of the "trophic" nerves. In favor of this view could be adduced the pallor and anæmia of the affected skin generally present, as well as the observation lately made by myself that in some patients a reddening of the bald skin produced by faradization during the acme of alopecia persists for many hours, but lasts for a briefer period as improvement progresses.

To be sure, on the whole, the understanding of the morbid process is but little facilitated by such an hypothesis. "That the vaso-motor nerves are to be considered under all conditions as the regulators of the local nutritive processes is beyond any doubt. But then it is equally unquestionable that every pathological alteration goes hand in hand with a vaso-motor disturbance, and that, were the latter alone to be considered, all special pathology would be at an end."[3]

*Treatment.*—The believers in the parasitic theory have thought to find support in the fact that cure ensued after the employment of antiparasitic remedies. As the benign cases generally end in recovery spontaneously, there is but little argumentative force in this circumstance, all the more because many of these agents also have that irritant effect on which great value has been placed. In order to produce this effect, Kaposi uses ethereal oils in alcoholic solutions or irritant alkaloids dissolved in alcohol; for instance, Ol. macis, 8 parts; Spirit. vin. rectificati, Spirit. lavandul., āā 30 parts; or, Veratrin., 0.4 parts; Spirit. vin. gallic., 90 parts; Spirit. lavandul., 30 parts; Glycerin., 15 parts; these are rubbed once or twice daily with a bristle brush into the bald spots and the skin immediately adjoining. Should the skin become much red-

[1] "Die niederen Pilze u. s. w." München, 1877, p. 48.

[2] L. c., 1, pp. 23–30.

[3] Kaposi, l. c., Bd. ii., p. 544.

dened and desquamate, the application is to be made at longer intervals and with less vigor. Rindfleisch observed rapid improvement after the use of a mixture of equal parts of tincture of capsicum and glycerin.

A still more energetic procedure seems to have found favor of late in France.

Vidal has "the hairs on the affected part of the scalp shaved off" every two days, when a blistering plaster is put upon it. This is removed as soon as the epidermis begins to become detached, and after two days a fresh plaster is applied. It is said the affection ceases to spread after two or three applications of the plasters. This procedure is continued until vigorous hair begins to sprout. Then tincture of cantharides is rubbed into the affected skin morning and evening with a tooth brush. Besides, ablutions with decoct. fol. jugl. and caustic liquor ammonia are said to have proved advantageous. Should the affection be located in the beard, daily shaving and the application of tinct. cantharides in conjunction with the above ablutions are said to suffice.

After the neurotic theory had been advanced, it was natural that electricity should be tried.

Waldenstroem applied galvanism by placing one pole over the superior cervical ganglion of the sympathetic, the other upon the hairless spot. In the two cases in which the method was tried it is said that the hair began to grow in from six weeks to two months. I applied galvanism in a grave case without effect.

Pick saw recovery occur in a few cases after the use of pilocarpine, but he justly hesitates to ascribe the effect solely to this agent. In our practice, pilocarpine proved of no use, despite its long and energetic (subcutaneous) employment, in a case of the malignant type.

During the last few years we have employed a combined method of treatment with very satisfactory results, especially also in some grave cases; it aims, on the one hand, at a mild irritation of the skin; on the other, at the invigoration of the general health.

Our treatment consists in the employment of five-per-cent saline baths at a temperature of 28–29 deg. R., lasting twenty-five minutes. The baths are taken three times a week, and while the patient is in them the affected parts of the skin are lightly rubbed with a flannel rag moistened with the salt water. Twice a week the affected skin is irritated by faradization with brush electrodes. Each sitting lasts ten minutes. On the days when no bath is taken, friction with more concentrated salt solutions, according to the sensibility of the skin.

These frictions may be used daily in slight cases, instead of the baths. They are always conjoined with roborant diet, sometimes with iron.

### ALOPECIA NEUROTICA.

Under the above title we group together all forms of loss of hair in which the latter occurred as a concomitant symptom or sequel of diseases in all probability caused by disturbances within the nervous system; or, owing to its having been confined to the distribution of certain nerves, found its explanation in connection with them. However, such an influence, although appearing probable on the strength of clinical observation, cannot as yet be proven either anatomically or physiologically.

*I. Alopecia after Traumatic Affections of the Cerebrum or the Peripheral Nerves.*

There is on record, first, total loss of hair affecting the whole body after traumatic cerebral affections.

Cooper Todd observed in a man æt. 45, after a fall from a wagon, hemiplegia, unconsciousness, and delirium. Improvement set in gradually, but headache continued. "One day, as he was going to shave himself, he could not find any beard;" finally, the hair of the head and that of the rest of

the body fell out. Todd at the same time recalls a case reported in "Holmes' System of Surgery," in which the head had been struck by lightning, and the next day not only all the hair fell out, but the toe-nails also dropped off.

In 1876, I presented before the Verein für wissenschaftliche Heilkunde at Königsberg an old man who, forty years before, had fallen through the charred floor of a burning house. After that, he states, he had lain in bed unconscious for a year. When he got up again, he was not yet quite bald, but a year afterwards he had lost all his hair. The examination proved that the patient was absolutely bald: not a single downy hair even could be found on the whole body.

Ravaton observed a unilateral loss of all the hair of the scalp and face in connection with amaurosis of the eye of the same side after concussion of the brain.

H. Schultze[1] describes partial loss of hair confined to the right temporo-frontal region after a traumatic cerebral affection, accompanied by hemiplegia of the right half of the face and of the left upper and lower extremities.

While the hemiplegia recovered in a year, the right facial paralysis continued, and a very considerable atrophy of the soft parts of the right half of the face and complete anæsthesia of the right trigeminus developed. The hair-limit of the right frontal region was displaced backward by an oval alopecia, 8 cm. in its greatest diameter, terminating in a shallow arc.

Fischer noticed, after gun-shot wounds of the nerves, defluvium capillorum on the corresponding extremities to such a degree that the parts appeared as if shaven. As a rule, the loss was preceded by great proliferation of the hair. The nutritive disturbances of the skin described by Fischer were absent in a large number of grave nerve lesions; they occurred, when the motor fibres alone or chiefly, or finally when the sensory and motor fibres synchronously, were affected by a trauma.

*II. Alopecia in Connection with Diseases of the Nervous System due to Internal Causes.*

With the melancholic forms of the psychoses, a diffuse loss of hair has been frequently observed, associated with other symptoms of impaired general nutrition. Besides, in melancholiacs, local alopecias occasionally develop; they often follow pretty closely the distribution of certain nerves, an instance of which, confined to the auriculo-temporal nerve, I have recently observed.

Loss of hair confined to isolated parts of the body is found, furthermore, in progressive (facial) atrophy—an affection whose trophoneurotic character has been recognized almost generally, despite the objection of a few prominent investigators (Cohnheim).[2]

*Circumscribed Atrophy* (Virchow), which has been most frequently observed on one-half of the face (chiefly the left), but at times also on other parts of the body, consists in an atrophy—of very slow course in young persons—of the subcutaneous fat, the skin, the underlying bones, more rarely of the muscles. The affection of the hair manifests itself either in decoloration and complete whitening, or the hairs fall out, or their growth is more or less diminished. The disease may extend to the entire capillary growth on the affected part of the skin, or else it may be confined to some irregularly circumscribed, often stripe-like regions.

Such a stripe-like loss of hair for instance, occurred in the much-quoted first case of Romberg.[3] The baldness in the Schwan case is termed triangular by Romberg, and stripe-like by Virchow.

In one case, for which I am indebted to Professor Berthold, the atrophic patch, the breadth of a finger, extends from the middle of the ciliary border of the upper eyelid upward, ending a little way above the region of the eyebrows, without any sharp demarcation; eyelashes and brows are lost within the affected strip. But in a case of Hueter and Axmann, the hair had been lost in the tem-

[1] L. c., p. 225.

[2] "Vorlesungen über allgemeine Pathologie." 2 Aufl., Berlin, 1882, Bd. 1, p. 594.

[3] L. c., 1.

poral region and the side-whiskers; in one of Courtel, in the greater part of the beard on the diseased half of the face.

There seems to be hardly any doubt that the case described by Gibney belongs in the category of circumscribed atrophy. Here the disease had set in in the third year of life, with a dirty-brownish discoloration of the skin in the region of the left inferior maxilla. In the ninth year, there were present distinct atrophy of the left half of the face, whitening of some bunches of hair on the left side, and baldness below the left parietal bone.

Falling of the hair of the head is stated by Eulenburg to be a well-known fact in cases of frequent attacks of migraine.

Furthermore, we must mention those not very rare cases in which loss of hair is associated with symptoms of sensory irritation, for instance, neuralgias of the supra-orbital nerve, in the region in which the affected nerve extends. Eulenburg[1] demonstrates on a very instructive case of Romberg's what minute gradations exist between them and circumscribed (progressive) atrophy; how, in the combination of neuralgic and trophic symptoms it often depends only upon the temporary preponderance of this or that group of symptoms and the judgment of the author, whether a case is designated as supra-orbital neuralgia with trophic symptoms, or as circumscribed atrophy with neuralgic manifestations.[2]

Finally, we must mention H. Schultze's case of a boy æt. 7 years, in whom patches like alopecia areata were found on the scalp by the side of papillomato-verrucose excrescences arranged along the course of a large number of cerebral and spinal nerves.

Lanugo was present on all affected portions, no spot was quite bald. The diseased hairs were partly in stripes, partly irregular with map-like outlines, but kept "strictly" along the course of the supra-orbital, the great occipital, and the auriculo-temporal nerves.

*Concluding Remarks.*—In the cases here collected, the description of the special character of the alopecia is on the whole incomplete. Where more complete histories are given, the alopecia supervening on a neurotic base shows an imperfectly marked type and "acyclical course" (Auspitz); and, in our opinion, it is just in this that the above-mentioned cases of regional loss of hair differ materially from alopecia areata. In alopecia neurotica there is frequently only a thinning out of the hair; complete loss occurs at no period of the disease. Where total defluvium is reported, we find the form of the bald spots described as altogether irregular and the transition into the still hairy portion as quite gradual. Under these circumstances it does not appear appropriate to efface the clearly marked outlines of the morbid picture of alopecia areata by the incorporation of this material. Withal, there is no intention of denying the possibility that occasionally a weakening of the physical constitution produced by neurotic influences may predispose to the development of alopecia areata. The prognosis and treatment of alopecia neurotica depend upon the character of the primary nervous affection.

### EXPANSIONS AND FISSURES OF THE HAIRS.

In manifold conditions leading to disturbed nutrition of the hair, inspection shows on a larger or smaller number of hairs certain appearances which are so obvious that they do not escape any observer. The hair does not terminate in a fine, blunt point or in a cut surface produced by the barber's shears, but is broadened, and a moderate magnifying power shows that the increased circumference is due to a broom-shaped fissuring of the hair-shaft. Where this appearance is found on many hairs, it is easy to gain an in-

[1] Eulenburg, loc. cc.

[2] See Romberg, l. c. 2, p. 91, and Eulenburg, Handb., l. c., p. 66.

sight into its gradual development. In the first place, we encounter hairs which do not as yet show any pronounced degeneration of the cortical substance, but merely a fusiform expansion of the shaft.[1] A clearly marked longitudinal striping within the expansions indicates that the fibres are preparing to separate. The cuticle is absent on the swelling and generally also for some distance beyond. At a more advanced stage actual disintegration of the cortical substance has taken place at a spot corresponding to the fusiform swelling, but the upper and lower ends of the shaft still cohere, the sharp points of the cortical scales spread outward in part, but part of them are interlocked, like the stretched spread fingers of two opposed hands; in this way arises the oft-described picture of the interlocked brushes.

When such a hair is bent, the shaft forms an angle at this point; a slight traction at the lower end of the diseased hair, such as is unavoidable during combing or brushing, completes the partial solution of continuity, and thus arises the alteration of the point from which we started in our description. If we add that farther along the shaft, or even at several points at regular intervals, the initial stages of the process can often be recognized, we have stated the main features of this phenomenon to which Kaposi has given the name of Trichorrhexis nodosa.

The hair of the beard forms the favorite location of the affection under discussion. Only two cases have been published of such an affection of the scalp hair, under the name of trichoptilosis. I have frequently observed in persons suffering from one or other form of premature alopecia that a large number of the hairs present the appearance of "expansion and bursting" (Beigel), and I can state that "this phenomenon, analogous to all atrophic processes, occurs very frequently and on hairs of any part of the body." Moreover, I believe it to be altogether equivalent to the fissuring of the hair, and both conditions the expression of an abnormal dryness of the hair-shaft.

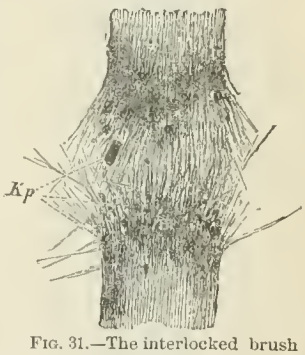


FIG. 31.—The interlocked brush appearance (part *Tn.* of Fig. 32 under a higher power—300: 1); *Kp.*, carbon particles.

In not a few persons, with otherwise vigorous growth of hair, many of the uncut hairs divide at the point into several, usually two or three, fibres, not always of equal length. Such hairs sit loosely in their follicles, and their root ends present the appearances of senility. Therefore, the fissure developed at a time when the connection of the hair with its matrix was already loosened, and there is no great difficulty in explaining its nature by an insufficient afflux of nutrient plasma to the portions at the greatest distance from the matrix, leading to drying-up of the cement substance and thus to a disintegration into several fasciculi. The point of each fasciculus in these cases, almost like the product of the physiological change of hair, shows the identical broom-like fissuring described above as the consequence of a pathological condition.

However, on those hairs which present the symptom of "expansion and bursting" we find, with extraordinary frequency, a combination with fissuring of the shaft into larger longitudinal splinters. At one point, perhaps, we find the appearance of the interlocked brushes; a short distance away, the shaft, often for a length of several millimetres, is split into two or more fasciculi; the point is divided into a few fibres, each of which shows the broom-like fissuring. But even in the picture of the interlocked brushes

[1] See my Fig. XVI. in Volkmann's Sammlung klin. Vortr. (No. 120).

we can frequently convince ourselves that the total disintegration was preceded by a fissuring of the shaft into larger longitudinal splinters.

As a rule, the partial longitudinal fissuring occurs almost exactly in the middle of the shaft, and then of course destroys the medullary cylinder if the latter is present; but at times the shaft divides into one larger piece including the medullary cylinder, and one or more smaller ones.


FIG. 32.—Lower part of a scalp hair; brittleness of the hair shaft, trichorrhexis nodosa (*T. n.*); scissura pilor. (*S. p.*). The preparation is derived from a girl aged twenty-two, suffering from alopecia pityrodes. Magn. 40. diam.

The portions of the shaft which are deprived of their cuticle, rough, fissured, or perhaps quite frayed out, form excellent traps for atmospheric dust; all imaginable granules accumulate there, and partly are so firmly wedged in the fibrous tissue that no method of preparation can altogether remove the more resisting ones. Especially conspicuous are the dark, chiefly angular particles of carbon (Fig. 31, *K. p.*) and the blue ultramarine granules.

A not inconsiderable quantity, comparatively, of air lodges in all the smaller or larger fissures and cavities formed by the spreading of the cortical fibres, and causes the dull-gray coloration of the expanded portions of the shaft. In mounting the specimen, this accumulated air is displaced by the added fluid, and this takes place the more rapidly if the fluid is capable of completely severing the loose connection still existing between the several layers of the cortical substance. This probably explains the fact that, when a hair thus affected was treated with concentrated acid under the microscope, a number of very large bubbles were disengaged, while from a healthy hair only small air-bubbles arose. Beigel concluded that gas probably developed within the hair by the decomposition of the medullary substance. But this condition is largely noticed also in hairs which have not even a trace of a medullary cylinder—a fact which alone demonstrates the untenability of the hypothesis.

A few modern investigators found fungi in the expanded portions of the hairs and designated them as the cause of the disease. There is no doubt that analogous metamorphoses in the hair shaft may indeed develop on a mycotic base. They have been described and figured by v. Bærensprung in mycosis circinata.[1]

However, in those cases in which the presence of a mycosis was not proved at the same time by symptoms on the skin, we have never been able to demonstrate an etiological relation of vegetable parasites to trichorrhexis nodosa.

While studying this affection, we become convinced that where the above-described roundish swellings of the shaft are present in greater number, the growth of hair on such parts of the body appears dull and lustreless throughout, and has a dry feel; we find,

[1] Charité-Annalen, Bd. vi., 1, Pl. 2, Fig. 2.

besides, that symptoms of atrophy or premature senility are perceptible on many hairs (cornified, narrow, often frayed-out hair-bulb, absent or imperfectly developed medullary cylinder, faultily formed cuticle). Aside from the fissured and divided portions of the shaft, the cohesion of the hair is not materially decreased. On weighting a portion of the shaft, which in its external aspect does not appear degenerated, until it breaks, the torn ends show only quite exceptionally a fissuring like the points of fracture of a portion of the shaft deteriorated by trichorrhexis nodosa; but similar appearances are more frequently obtained with hairs exposed to an equable flattening pressure such as may be exercised, perhaps, by a spring.

A few words remain to be added about the fact that trichorrhexis nodosa has hitherto been chiefly observed on the hairs of the beard. This is explained in part by the fact that the beard hair, which on an average is nearly twice as thick as the scalp hair, makes the correspondingly larger roundish swellings appear more conspicuous. While the nodules due to the disintegration of the cortical substance on thin scalp hair can at most be felt, but hardly seen with the unaided eye; on the beard hair, owing to their form, size, and indefinite grayish color, they are not rarely even mistaken for eggs of pediculi. However, the beard hair seems to possess a real predisposition to this alteration owing to its thickness, its natural curliness, and its more flattened shape going hand in hand with the latter (Henle).

To resume briefly the views laid down in the preceding pages:

1. The above-described expansions and fissures in the course of the hair-shaft are not separate diseases, but a morbid symptom—the expression of an abnormal dryness and brittleness of the hair due to atrophy.

2. Broom-like fissuring, and division of the shaft into larger longitudinal splinters are equivalent processes; both are initiated by loss of the cuticle, they are often combined, and largely merge directly into each other.

3. The region of the beard is the place of predilection of trichorrhexis nodosa, but its occurrence on the scalp hair is by no means rare, and is less conspicuous there only on account of the smaller dimensions of the nodules.


FIG. 33.—Nodulus laqueatus of a scalp hair fissured in its lower part. *B*, cotton fibres; *F*, feathers. The specimen is derived from the same young girl as that illustrated in Fig. 32. Magnified 90 diameters.

Therapeutically, shaving of the hair is useless. A rational symptomatic treatment will have to aim at counteracting the pathological dryness of the hair, and for this purpose may be recommended the systematic oiling after preceding removal of the fat, described in detail under alopecia pityrodes.[1]

[1] Schwimmer believes that he secured improvement in one case by the application of the following ointment: Flor. zinc. 0.5 gram; Flor. sulphur., 1 gram; Ungt. spl., 10 grams. M. S. To be rubbed in morning and evening.

We add the description of other, in part only apparent, expansions of the hair-shaft.

1. Real knotting. I have repeatedly seen such noduli laqueati on dry and rather curly scalp hair, occasionally combined with the symptom of trichorrhexis. The spaces within the loops form excellent hiding-places for dust; tiny feathers, colored and uncolored cotton fibres and similar objects are also caught therein and transform some of these noduli into upholstered miniature nests. The production of these knots appears to us less remarkable than it does to Duncan Bulkley, who observed them once on the hair of the pubic region and mistook them for the eggs of morpiones. Obviously our noduli laqueati arise in a purely mechanical way from awkward combing or disarranging the hair with the fingers.

2. Axillary and genital hairs of strongly perspiring persons are at times found covered for nearly their entire length with an uneven deposit apparent even to macroscopic inspection. Microscopic examination shows that the peripheral layers of the cortical substance are here and there barbed like feathers, and that the shaft is surrounded, sheath-like, in many places by roundish, various-sized convolutions of cornified, non-nucleated, yellowish-colored masses which are quite resistant to the action of acids and alkalies. These masses adhere directly to the cortical barbs, crystallized upon them, as it were. This condition is to be attributed to the macerating influence of profuse sweats; it may be very aptly classified under the term trichoptilosis, introduced by Devergie for similar conditions.[1]

3. Walter Smith observed on a nineteen-year-old, formerly healthy girl, a shortening and thinning of the scalp hair, with regularly arranged fusiform swellings (six to thirty-six on one hair) of the shaft of about one millimetre in circumference. On these parts the hair was more darkly pigmented and thus presented a brownish-white speckled appearance (ringed hairs? M.). Within the swellings were neither cell accumulations nor fungi. As opposed to trichorrhexis, the cuticle had but a slight tendency to rupture; if the continuity was broken, it was never through a node, was not frayed out, but smooth.

4. Lastly, Malcolm Morris laid before the London Pathological Society preparations from cases in which the hard nodes were merely seated on the scalp hair, and contained a honey-like mass of pigmented, spore-like cells. Morris interprets this disease as the result of the application of some slimy hair-oil (?).

## ANOMALIES IN THE COLORATION OF THE HAIR.

The congenital decoloration of the hair, as well as the whitening associated with loss of pigment of the skin, will be discussed in the chapter "Anomalies in the Coloration of the Skin."

The delicate hair with which the child comes into the world is gradually replaced by more vigorous, thicker, and more distinctly colored hair. During puberty the color of the human hair varies from faintly yellow, through red and brown, to coal-black; according to Wilson's[2] measurements, the darker hair is also of greater thickness.

Most of the nutritive disturbances affecting the hair act injuriously also on the intensity of the color of the hair, and even in the regular change of hair the lowest segment of the shaft, being near the end of its typical duration of life, is generally distinguished by fainter coloration.

The pigment-substance saturates all the elements of the hair, and is especially uniformly distributed in its fibre-cells; there is found, besides, granular pigment between the several rows of cells.

Colorless hair appears white according to physical laws, owing to the unevenness of its surface and the air-bubbles, a moderate quantity of which is usually contained in every hair, partly within, partly between the cells; according to the degree of pig-

[1] Comp. R. Pfaff, "Das menschliche Haar, etc.," 2te Auflage, Leipzig, 1869, p. 72; and Oesterlen in "Handbuch d. gerichtl. Medicin," herausgegeb. v. Maschka, p. 521.

[2] "On the Management of the Skin," London, 1847, by Henle, l. c., p. 32.

ment-defect and air-contents, various shades of color, from gray to snowy whiteness, arise.

### SENILE AND PRESENILE DECOLORATION.

The gradual decoloration of the hair, the whitening, usually precedes, as above stated, the alopecia induced by the senile alterations of the skin; generally it shows itself first on the temporal, then in the beard region, and so constant a symptom is it of the senile involution of the body that it has not without reason been termed physiological. The decolored hairs are few in the beginning, but become more plentiful in the course of years; in the mean time, the decoloration of the several gray hairs becomes more intense, the still blond or dark hairs even are no longer tinged as strongly as formerly, the beginning decoloration usually first manifesting itself at the lower, only exceptionally at the pointed part of the shaft. After the hair-follicle has once formed a gray piece of hair, it produces, as a rule, in the further growth of the same, or in the substitution of another in consequence of the typical change of hair, again a gray hair (Pincus).[1]

Upon microscopic examination, it will be found that the process is based on a gradual decrease of the pigment-contents; in the still faintly colored, but not completely blanched hair, there are often between the several rows of cells still rather numerous pigment granules.

The hair of younger persons may also turn gray in a manner quite analogous to canities senilis. This presenile decoloration often takes place in a growth of hair otherwise absolutely normal, which, in many instances, remains free from the complication with alopecia for decades, even to the most advanced age.[2]

The insufficiency of pigment in senile and premature whitening is usually ascribed to the papilla having lost its pigment-producing power, in consequence of which the hair-tissue is "pushed out" deficient or lacking in color. We might also assume that it is not the papilla which has lost the power of producing pigment, but the hair-cells which have lost the capacity of imbibing it.[3] Both these factors, however, do not suffice to explain

### THE SUDDEN WHITENING,

authenticated examples of which have especially of late been reported by competent observers.

A compositor, aged thirty-four years, admitted to hospital July 9th, 1866, with symptoms of delirium cum tremore. Until improvement began to set in (July 13th), he was continually tormented by terrifying pictures of the imagination. In the night preceding the date named, the hair of the head and beard of the patient, formerly blond, became gray.

Brown-Séquard discovered one morning in his face, on symmetrical places of his dark beard, a few white hairs which he had not noticed the day before. He epilated them, but two days later he again found in the same region on the right three, on the left two hairs which were gray throughout their whole length, besides numerous others decolored only at their lower ends. The experiment of pulling out all the gray hairs was several times repeated with a like result during the next five or six weeks. Brown-Séquard closes his brief communication on this subject with these

[1] L. c., p. 181.

[2] In senile canities, we find among the perfectly white hairs a larger number of short hairs than is proportionate to the total loss, or perhaps to the completely colored hairs (Pincus, ibidem).

[3] It might also be investigated whether the abundance of pigment in the senile skin is not in part connected with the fact that coloring matters, originally intended for the hair, are again taken into the circulation and deposited elsewhere.

words: "Ces expériences mettent hors de doute la possibilité d'une transformation très-rapide (probablement en moins d'une nuit) de poils noirs en poils blancs."

Raymoud likewise reports (l. c.) a case of sudden whitening observed by himself together with Vulpian.

In view of so well-authenticated observations, it appears neither judicious to doubt the possibility of sudden whitening, nor necessary for its illustration to go back to the older, in part exaggerated cases.

Accurate examination by Landois of the hairs of the patient first mentioned above showed that the pigment contents of the hairs of a man turned gray over night had remained unchanged, and that their predominating white color was due solely to an excessive development of air bubbles in the hair-shaft.

Despite this positive demonstration, several questions remain unanswered. We know neither what immediate circumstances produce such an abnormally large amount of air within the hair, nor wherein the persistence of the canities, after its sudden production, finds its cause.

### WHITENING IN CONNECTION WITH ALTERATIONS OF THE NERVOUS SYSTEM.

Popular belief brings the premature, and especially the sudden whitening into connection with depressing mental emotions. We might instance the German expression "Sich graue Haare über etwas wachsen lassen" (to worry one's self gray).

This popular view has gained some scientific basis by the fact that alienists have observed very rapid whitening of the hair in melancholiacs.[1] Neuropathologists, moreover, maintain that not only psychical, but also several other central and peripheral alterations of the nervous system may produce decoloration of the hair.

In circumscribed facial atrophy, the hair often falls out, or its growth at least is more or less largely reduced; in other cases, however, the disease of the hairs manifests itself in a decoloration affecting sometimes only strips of the scalp, or of the eyelashes and brows; sometimes the entire affected region. Berger reports a whitening of the hair of the head and face confined to the paralyzed right side in post-typhoid hemiplegia. Communications are on record of local decoloration of the hairs of the scalp, the eyebrows and eyelashes, in neuralgias of isolated branches of the trigeminus, especially the supra-orbital nerve. While these are all cases of permanent decoloration, we also hear of instances in which a partial whitening of the hairs occurs with the single neuralgic attack, and again disappears. Less clear is the dependence of regional canities upon neurotic influences in the following case.

After traumatic ophthalmitis of the left, and sympathetic inflammation of the right eye in a nine-year-old, vigorous boy, Schenkel observed a group of ciliæ of the right upper lid, and nearly all the lashes of the upper lid of the (enucleated) left eye turn silvery-white within a very short time.

The importance of inherited tendency in the gradual presenile canities is universally recognized, and it almost seems as if persons with hereditary neuropathic taint, even if otherwise normally constituted, are pre-eminently prone to early poliosis.

### DECOLORATION OF THE HAIR AFTER WASTING GENERAL DISEASES; CHANGE OF THE COLOR OF THE HAIR.

Quite a different character from the forms of poliosis hitherto discussed is presented by the decoloration of the hair occasionally seen in connection with wasting general dis-

[1] Birch-Hirschfeld, "Lehr. d pathol. Anat.," p. 654, Leipzig, 1876.

eases. Here it usually happens that, after a rapidly developed alopecia, but which generally persists a comparatively short time, the subsequent growth of hair is quite or almost colorless. If the typical change of hair has once been re-established, the uncolored hairs may in the course of time be replaced by pigmented ones.

At times, however, the after-growth shows from the start, or after a transitional stage of decoloration, quite a different tint from that of the former hair. We have reported one such case above (p. 419); analogous observations are repeatedly found in the literature.

Of special interest is a case reported by Compagne.[1]

The black hair of a woman aged thirty-six years began to fade on the twenty-third day of a malignant fever, and on the sixth day following was perfectly white; but on the seventh day they became darker again, and on the fourteenth day after the first change of color they had regained the original black.

Such a temporary disappearance of the normal color of the hair has become easier of comprehension since Landois has shown that a sudden development of gas may lead to whitening.

Fig. 34.—Hair whitened in patches (ringed hair). A, by transmitted light; B, by reflected light (after Landois).

### PATCHY WHITENING OF THE SEVERAL HAIRS.

It has already been stated that the matrix which has once formed a decolored piece of hair, as a rule, produces thereafter only gray hair; very exceptionally, however, there appears here and there on single hairs a pigmented segment, after the hair has been formed colorless for months.

It is a very great rarity for the major part of the hair to be decolored in patches.

Richelot observed the case of a girl aged seventeen, suffering from chlorosis; during the disease the majority of the beautiful brown hairs became white from their roots to a distance of two inches. After the chlorosis was cured, the after-growth regained the normal color, so that the hairs were white only to the extent named. This last observation can be best explained by assuming that the hair matrix had interrupted its pigment-forming function for a time, and had resumed it as soon as the regular nutritive conditions had been restored. But the temporary supply of colorless material for the building-up of the hair is not the only way in which patchy decoloration of the several hairs is effected. We know from the observations of Spiess and Landois that it may be due also to interstitial development of gas.

Karsch reports (l. c., p. 34) the case of a laborer, aged nineteen years, in whom every hair of the scalp consisted of alternating brown and white rings. Similar alterations were found also on the hairs of the rest of the body. On microscopic examination

[1] "Handb. d. Anat.," v. E. Hildebrandt, herausgegeben von Weber, 4. Aufl., p. 200. Braunschweig, 1830.

of the hair (Spiess, Landois), the white spots appeared dark by transmitted light, and white by reflected light. When on the stage of the microscope penetrating fluids were added to the hair after it had been cut at a white spot, air-bubbles were disengaged, the fluid saturated the hair tissue, and the white patch assumed the same color as the adjoining brown ones; besides, the microscope confirmed the observation made by the touch, that the hair-shaft was expanded on the white patches, where it was distinctly, though slightly, thicker than on the brown spots.

In order to explain the origin of ringed hair (pili annulati—Karsch), Landois (l. c., 2) has formulated the hypothesis "that by an intermittent irritation of trophic and vaso-motor nerves, a hair-tissue is formed, within which a periodic interstitial development of gas takes place."

*Treatment.*

In the present state of science we can dispose briefly of the treatment of whitening of the hair. No further explanation is required to show that the "physiologieal" canities senilis is not amenable to treatment; but even for the other forms of whitening therapeutics will be available only in the very exceptional cases in which the dependence of canities upon a curable fundamental affection is probable. We know as little of remedies having a direct influence on the pigment-forming function of the hair matrix as we do of such as might be able to check a disposition to the development of gas.

According to old chemical analyses (Vauquelin [1]), the color of the hair is due to contained sulphur, iron, and an oily ingredient. With the idea "of supplying the body with those substances which it lacked for the pigmentation of the hair," Eble and Pfaff gave these metals internally and had the head anointed with yolk of eggs, which is well known to contain sulphur and iron in considerable quantity. The good results which both authors claim for this method of treatment are probably illusory.

The hair possesses the quality of absorbing dye stuffs supplied to it from without. To this quality is due the abnormal coloration of the hair connected with some industrial occupations (blue color in cobalt and indigo workers, green in copper workers).

The method of giving the hair a darker lustre by anointing with oleum nuc. Jugland., oleum cassiæ cinnamomeæ, oleum macidis, is harmless, but insufficient where the canities has gained some extent, and at best of very temporary benefit. The metallic dye stuffs (combinations of lead, sulphur, iron, copper, silver, and bismuth) have the reputation of having injurious influence on the health or at least on the growth of the hair. At present it seems that nitrate of silver has displaced all other hair-dyes. Clever hair-dressers secure by it, according to the concentration of the solution employed and the duration of its action, the most various shades, from light-blond to deep black. The application of the silver nitrate solution is to be followed by moistening the hair with a solution of levigated sulphur (about 3 : 100), where a blond tint is intended to be produced; for black, the latter substance is to be replaced by pyrogallic acid in a concentration of 0.5 : 200. Since the toxic effect of pyrogallic acid has become known,[2] some caution is to be advised in the use of this agent. The use of lead preparations is to be directly discountenanced.

I am assured by thoroughly reliable persons that dyeing the hair with silver nitrate, alone or in combination with sulphur, has absolutely no injurious effects.

Anilin colors are said to be inapplicable because they are washed off too readily.

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[1] Annales de Chimie, T. lviii., 1806, Avril, pp. 41–53; translated in Gehlen's Journal für Chemie u. Physik, 3 Bd., 2 Hft., No. 7, by Eble, l. c., p. 62.

[2] Neisser, Zeitschr. f. klin. Medicin, Bd. 1, Heft 1, 1879.

# ANOMALIES

# IN THE COLOR OF THE SKIN.

BY

E. LESSER, M.D.,

OF LEIPZIG.

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## PIGMENT HYPERTROPHY.

As in the different human races the pigmentation of the skin varies between the deep black of certain negro races and the often almost white color of the Caucasian, so we see similar, though much slighter variations in the color of the skin in the individual races, without our being able to term them pathological. In this respect we find in every race individual differences which may not be inconsiderable, but the cause of which is still quite obscure and which are not of the slightest pathological importance. The only etiology we are able to give for this is heredity. The diffuse pigment hypertrophy in certain diseases will be discussed hereafter.

In this connection it may be remarked that this congenital pigment hypertrophy always develops in extra-uterine life. In the strictest sense of the word, therefore, we can only speak of a congenital predisposition; however, this relation prevails especially in many cases of pigmentation, whether due to a physiological or a pathological cause, and in this respect I call to mind only the well-known fact that the children of the colored races are born with a perfectly white skin, and the pigmentation peculiar to them does not develop until the first period of extra-uterine life.

Diffuse hyperpigmentation is opposed to circumscribed accumulation of pigment which likewise is in part physiological, *e. g.*, the greater pigmentation of the nipples and genitals.

Among the pathological circumscribed hyperpigmentations we distinguish, as the first division, the nævi, lentigines, and ephelides which are either congenital or rest on a congenital predisposition; as the second group, the local pigmentations occurring with certain alterations of the body, the chloasmata, and the pigmentations in consequence of external irritations and after diseases of the skin.

## NÆVUS.

Under this title we group together those congenital alterations of the skin in which is present, in the first place, a circumscribed augmentation of pigment, but in which other parts of the skin, the corium, the papillary body, the corneous layer, may also be hypertrophied. Hence nævi may be divided for the present into two sub-classes—smooth nævi (N. spilus), in which we have to deal essentially only with an abnormal pigmentation, and verrucose nævi (N. verrucosus), in which other parts of the skin are at the same time more or less hypertrophic. Verrucose nævi may be still further subdivided into nævi cornei, pilosi, papillosi, and molluscifórmes ; but as we meet here with the most manifold combinations and transitions, it is impossible to strictly carry out such a division.

We have finally a third one, sharply demarcated by its etiology—that of nævi of the nerves (nævus unius lateris, v. Bärensprung ; papilloma neuropathicum, Gerhardt), characterized by the occurrence of formations corresponding to the other, either smooth or verrucose, but strictly confined to the region of one or several cutaneous nerves, the cause of which, consequently, must be ascribed to an intra-uterine trophoneurotic disturbance.

The smooth nævi represent simple pigment spots, varying in size from the head of a pin to the palm of the hand and even larger. Generally they are sharply but irregularly demarcated, and are sometimes surrounded by a border which, though darker than the normal skin, is still lighter than the central portions of the nævus. These nævi may be found on any part of the body, and no predilection for certain sites can be observed. They are not rare even on the points of transition between skin and mucous membrane, on the vermilion border of the lips, and on the glans penis. Their color is yellowish-brown or brown, and hardly ever attains the dark, often blackish-brown tint of the verrucose forms.

The anatomical examination of these spots shows that, besides an abnormally great pigmentation of the deeper layer of the rete mucosum, there is also a more or less great accumulation of pigment in the corium, and, according to Demiéville's[1] investigations, mostly in cordlike agglomerations of cells following the course of the blood-vessels—a fact which, together with the frequent presence of pigment deposits in the adventitia of the vessels, renders still more probable the direct origin of the pigment from the blood.

These flat pigment moles, as also the other forms of nævi, during extra-uterine life grow only in proportion to the enlargement of the territory occupied by them. Otherwise no change is to be observed on these spots. The skin at these places functionates quite normally, no desquamation occurs, and the nævi are of no consequence for their bearers, aside from the disfigurement and the danger of the development of malignant tumors.

The second group, the verrucose nævi, present the most manifold appearances. If slightly developed, they are but little elevated above the normal skin ; have an uneven, warty surface, are light to dark blackish-brown in color, and generally covered with numerous hairs. In more strongly developed cases, they assume a papillomatous character, the several elevations being higher and separated by deep furrows. Sometimes they present considerable hypertrophy of the corneous layer, every single protuberance being covered with a horny mass up to several millimetres in thickness. These forms, indeed, have in numerous instances been described as circumscribed ichthyosis.[2] These

[1] "Ueber Pigmentflecken der Haut," Virch. Arch., Bd., 81, p. 333.

[2] Flittner, "Ein Fall von umschriebener Ichthyosis cornea." Arch. f. Dermat. u. Syph., 1870, p. 653.

nævi with strongly hypertrophic corneous layer are sometimes surrounded by a narrow border within which the skin, though thickened, exhibits neither abnormally great pigmentation nor the formation of horn. They are not found covered with abnormally strong growth of hair, but generally only with a few lanugo hairs. In the highest degree of development, in which the subcutaneous connective tissue likewise participates materially, there finally arise actual tumors or even elephantiasis-like formations. The latter may cause true functional disturbances, for instance, when the eyelids are affected.

The size of these nævi varies extremely. Some are small, no larger than a lentil; others reach the size of a dollar, of the palm of the hands; often even whole regions of the body, in some cases almost the whole surface of the body is occupied by them. At birth, these nævi usually are but slightly pigmented, and gradually assume their subsequent dark color. The larger ones are mostly solitary, but sometimes are multiple. They do not enlarge, aside from the normal growth corresponding to the development of the entire organism.

The anatomical structure is extremely variable, but at all events we have always to deal only with true hyperplasiæ, never with heteroplastic formations of tissue.

Opposed to the forms thus far discussed is the third group, separated from them by the etiological factor—that of the nævi of the nerves. This form has become better known through v. Bärensprung,[1] who described it as Nævus unius lateris, and in analogy with zoster assumed for its cause an intra-uterine affection of the spinal ganglia. Since that time a whole series of cases has been reported, among others, by Neumann,[2] who gives a complete bibliography.

In these cases we find flat or verrucose nævi, often forming large tumors, the first obvious peculiarity of which, the one-sidedness, is expressed by the name chosen by v. Bärensprung. The distribution always corresponds to the region of either the trigeminus or of one or frequently of several spinal nerves. In Neumann's cases even one entire half of the body was darkly pigmented and partly covered with papillary proliferations. In such cases, of course, we must look for the cause not in the spinal ganglia, but in a more central part of the nervous system. As, in zoster, vesicles appear by no means on the whole field of distribution of the affected nerve, so in nævus of the nerves we usually find entirely normal portions of the skin between the altered parts; often the latter form only small islands in the otherwise normal skin, but the general arrangement always coincides with the distribution of the nerve. These nævi, too, aside from the normal growth, exhibit no alterations.

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Two other forms of local pigmentation, lentigines and ephelides, are very closely related to nævi, the former of which, especially, can hardly be separated from them. In the first place there are no essential anatomical differences, and in the second place, even the most weighty reason for separating them—that lentigines occur only during extra-uterine life, while the congenital formations alone can be included among the nævi—will not bear close scrutiny. For not rarely it may be observed that pigment spots appear in after-years at precisely the same places on which similar congenital anomalies are found in the parents or brothers and sisters of these persons. This fact cannot be explained in

[1] Charité-Annalen, 1863, Bd. xi., Heft 3.

[2] Oestr. Jahrb. f. Pädiatrik, 1877, Bd. ii., p. 165.

any other way than by assuming a congenital disposition which did not develop until a subsequent period. And so also in the case of ephelides, from the fact that they develop with such extraordinary frequency in persons with a certain color of the skin and hair, we are justified in drawing the conclusion that in them there is likewise a congenital disposition which does not declare itself in after-life except after the action of external causes.

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Lentigenes occur either isolated or in large numbers. They have no particular place of predilection and may be met with on any part of the body. Of course, they are most conspicuous in the face. Some are flat, others more or less elevated, and in that case usually set with a number of dark, thick hairs. Lentigenes, indeed, can only be distinguished from congenital nævi, both flat and elevated, if the beginning of the former has been observed during extra-uterine life. But if they are present without our knowing when they have appeared, they cannot be distinguished at all.

By ephelides, freckles, are meant those small pigment spots which seldom exceed the size of a hemp-seed, never appear singly, but always in large number, and generally exhibit a quite definite localization. Their form is irregular, and the outlines are generally slightly serrated. They are met with almost exclusively in the face, on the hands and arms, that is, on parts of the body which are usually uncovered, and are observed very rarely on covered parts, as the penis and the buttocks. In the latter case the persons in question have always numerous ephelides also on the usual places of predilection. Their color is never very dark, but chiefly yellowish-brown, at any rate never as dark as in the warty moles. Anatomical examination shows that there is essentially an increase of the epidermal pigment, without any accumulation of pigment in the corium.

Ephelides are never present at birth, but usually do not develop before the sixth or eighth year of life. They are conspicuous only in summer, while they fade in winter so as to be barely perceptible. In later years they generally disappear again. They are rare in brunettes, but extremely frequent in red-haired persons, who generally have a remarkably clear complexion.

In view of all these facts, it appears to me unquestionable that ephelides rest on a congenital disposition to these pigment formations, but which require for their development certain external conditions, especially the influence of light. I believe that this is the most natural explanation of their occurrence chiefly in certain individuals, and of the localization and the variations in intensity according to the seasons. Hebra has expressed himself against this view, especially because ephelides come under observation also on parts which are not exposed to the light. But this negative reason is insufficient, for there are other cases in which there is an influence on distant parts of the skin which are not directly affected by the agent producing the pigmentation.

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As regards the prognosis, nævi and allied formations are generally of no importance; still, in a few rare cases, they may give rise to an unfavorable prognosis. On the one hand, cases have been reported in which numerous nævi were found at the same time with melanotic sarcomata in internal organs,[1] and, on the other hand, the nævi themselves may develop into malignant tumors, usually melanotic sarcomata likewise, especially after the influence of any external irritation.[2]

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[1] Jablokoff and J. Klein, Vierteljahrschr. f. Derm. u. Syph., 1879, p. 632.

[2] Benzler: "Die Nævi als Ursprungstätte melanotischer Geschwülste." Diss. Berlin, 1880.

The treatment, therefore, will have to fulfil two indications—firstly, the removal of the disfigurement produced by the pigmentation, and secondly, the ablation of the nævi on account of the danger of the development of malignant tumors.

There are indeed some remedies by which the pigmented epidermis can be removed, and after the employment of which the new-formed epidermis contains at first less pigment than the preceding. These are some acids, the caustic alkalies, and particularly corrosive sublimate. In the case of flat nævi and ephelides, as well as of chloasma and local pigmentations to be discussed hereafter, the sublimate is best employed in one or two per cent solution, being either painted repeatedly over the affected place, or by dipping a piece of linen the size of the spot to be decolored into the solution and keeping it there for four hours, during which time it must not be allowed to become dry. This is Hebra's direction. Then follows a more or less violent exfoliation of the epidermis, while the new-forming skin is colorless or slightly pigmented. However, this result is unfortunately of short duration, and after a number of weeks the pigmentation is again as intense as before. A definite removal, therefore, will be possible only by operation. It is self-evident that the latter course alone will be effectual when the formation of actual tumors has taken place.

As regards the second indication—preventing the formation of melanotic tumors—it would really be most appropriate to remove all nævi and lentigines, unless insuperable obstacles are presented by their size; but inasmuch as nearly every man has a large number, this is of course a matter of impossibility. But, at any rate, it will be imperative to remove such a formation which manifests notable enlargement, even if there is no other alarming symptom.

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The pigment anomalies thus far considered stand opposed to a series of others which indeed rest on no kind of congenital disposition. These are, first, the pigmentations occurring with certain physiological and pathological conditions of the body; second, the pigmentations arising in consequence of external irritations, and lastly, those remaining after diseases of the skin.

The term chloasma gravidarum or chloasma uterinum is applied to those pigmentations occurring in spots which appear chiefly in the face, in rarer cases also on other parts of the body of pregnant women or those suffering from disturbances of the genital organs. The most common localization is in the face; the forehead and the temporal regions being most frequently affected. The discoloration forms large brown spots with sharp irregular limits; on the forehead they usually reach close to the hairy scalp, from which, however, they remain separated by a narrow light stripe; less frequently they occupy the cheeks, the nose, and the parts around the mouth. Often the spots reach the size of the palm of the hand, at other times they are smaller, and then usually appear symmetrically; in the larger ones there are often light stripes or islands. In rarer cases, similar spots occur also on other parts of the body, occasionally there may ensue even a darker pigmentation of the entire surface of the body.[1] This discoloration imparts to the face quite a peculiar changed expression.

That these pigment anomalies are really connected with the functions of the genital apparatus is perfectly certain. They never occur in girls before puberty, they recur in many women with every pregnancy, after the termination of which they fade, and they finally disappear at the menopause. In the same way we see, in women suffering

[1] Rayer: "Trait. des mal. de la peau." Brux., 1836, p. 388.

from some uterine disease and affected with chloasma, that, with the recovery from the former trouble, the latter likewise disappears.

The proximate causes of these accumulations of pigment are altogether unknown.

Similar local pigmentations are observed in the train of certain exhausting diseases, particulary phthisis pulmonum, whence they are called chloasmata cachecticorum. The pigmentations, especially of the skin of the face, in congenitally syphilitic children also would belong under this head. These forms, of course, come under observation both in men and in women.

To these alterations are to be added the pigment changes induced by external irritations, which are termed chloasma calorieum, toxicum, and traumaticum. Generally known is the "tanning" of parts of the body which are long and often exposed to the light of the sun, as the face and hands after a prolonged sojourn in the country, but especially after tours across glaciers and fields of snow where the sun's power is heightened by the reflection. For the same reason, in country people, the face and neck, the arms as far as they are exposed, the feet and legs, often also a part of the chest, become in summer quite deep brown, so dark that the color often equals that of a mulatto. These colorations fade again in winter.

The influence of sunlight on the development of pigment has been pointed out above under ephelides, and it becomes manifest, furthermore, if we simply bear in mind the fact that the inhabitants of the hotter zones are always more darkly pigmented, while the inhabitants of colder zones are lighter in color. I am inclined to believe that, in this sense, the color of the darker races may be looked upon as a chloasma calorieum, which, by inheritance in the course of long ages, became gradually intensified until it finally remained permanently.

Besides, the pigmentations of the skin provoked by chemical irritations are exceedingly frequent. I shall enumerate here only, as the best known, the pigmentations after the employment of mustard poultices, cantharides, iodine, and chrysarobin. A single application of a mustard poultice for a few minutes may be followed by an augmentation of pigment at the point in question, which may frequently persist through life. The employment of cantharidal plaster may likewise give rise to these persistent pigmentations.

The coloration of the skin after the employment of chrysarobin is of a different nature. For not only the places coming into direct contact with the drug are stained, but the pigmentation extends over far greater portions of the skin; ordinarily dark colorations appear most rapidly in the face, around the eyes, although it is with special regard to the eyes that the application of remedies containing chrysarobin is never made to the head, or at least never should be made. Chrysarobin produces a diffuse dermatitis, accompanied by intense pigmentation, which occasionally may extend over the whole surface of the body, even if but isolated portions of it have been treated with this agent. The spots to which the most immediate effect of the chrysarobin was directed, that is, the points of the psoriatic, syphilitic, or other efflorescences, on account of which the remedy was employed, remain uncolored and subsequently appear as light islands on a dark ground. The cause of this immunity has not yet been cleared up. The discoloration of the skin after the employment of chrysarobin is generally a very dark brownish-red to brown. Fortunately the normal color of the skin is restored in one or two weeks, after a general desquamation of the epidermis.

Finally, we may apply the term chloasma traumaticum to those pigmentations of the skin which are brought about by external influences of a mechanical nature. Such pig-

mentations may arise at points exposed to a frequently repeated, but not continuous pressure from clothing, tools, etc. Furthermore, all the lesser injuries inflicted on the skin almost always leave small pigmented patches or cicatrices with strongly pigmented surroundings. (The lesions produced by parasites, and by scratching.) These pigmentations, by their arrangement and localization, often permit us to deduce from them their respective cause, even if it have been long removed.

It need hardly be mentioned that in the chronic cutaneous diseases accompanied by itching these pigmentations reach the highest degrees (prurigo and intractable pediculi vestimenti). In these cases—that is, in patients suffering for a long time from an intense prurigo or in individuals affected for decades with clothes lice—we observe pigmentations of the skin which may impart to it almost the color of the negro.

A partial pigmentation of the skin is produced by a combination of chemical and traumatic irritations, namely, by Baunscheidtismus. This procedure consists in the application of a small scarifying apparatus with a number of fine, circularly arranged needles and friction of the wounds with a substance consisting in the main of croton oil. This leaves behind very neat small circles of brown dots.

Finally there is a whole series of cutaneous diseases which provoke an increase of pigment, viz., those which give rise to chronic hyperæmias. It is impossible to specially enumerate every disease belonging under this head, because almost every chronic dermatosis may produce excessive pigmentation in this manner. These hyperæmias and their sequels, the pigmentations, appear most intensely on parts of the body in which the circulation takes place under unfavorable conditions, hence particularly on the legs. The deep pigmentations around ulcers, or the cicatrices left by them, I should ascribe likewise to the fact that a chronic inflammatory condition has prevailed for a length of time at these places. The cause provoking these ulcers is quite immaterial as regards the secondary pigmentations. In these processes, however, the pigmentation does not rest simply on an increase of pigment in the deepest layers of the rete mucosum, but there are almost always accumulations of pigment in the corium which are derived from the transformation of the coloring matter of the blood in former small extravasations.

However, two diseases require special mention in this respect, viz., lichen ruber and syphilis. The deep, often brownish-black pigmentations in the former disease are well known, and I refer to the respective section of this book. Also as regards syphilis, it is a well-known fact that the efflorescences on the skin very often disappear while leaving deeply pigmented spots; particularly the papular efflorescences, not alone those belonging to the secondary period which heal without the formation of cicatrices, but in a still higher degree those tertiary papular eruptions which almost always terminate with the formation of cicatrices. In such cases we find quite constantly at the place of the papule a slightly depressed cicatrix which is at first dark-brown in color, but gradually becomes perfectly white. Mention has been made above of the chloasma-like pigmentations of hereditarily syphilitic children, and still another alteration of pigment occurring with syphilis, the so-called pigment syphilis, will be discussed under a different head.

We can hardly speak of a treatment of these conditions, aside from the pigmentations in syphilis; however, occasionally a trial might be made with the above enumerated agents for the removal of pigment. In syphilis, of course, the most rapid absorption of the pigment can be expected from an appropriate general treatment and the local application of emplastrum hydrargyri; but the pigmentations are much more rebellious to treatment than the other symptoms.

## APPENDIX.

### ALTERATIONS OF THE SKIN IN ADDISON'S DISEASE.

This disease is likewise accompanied by a great increase of the pigment of the skin, but the pigment hypertrophy is merely an isolated symptom among a whole series of others.

Although this alteration in the color of the skin yields in importance to the other symptoms of Addison's disease, it still is a very significant symptom, inasmuch as it often appears as the first conspicuous sign of the affection. With the progress of the affection the dark pigmentation of the skin likewise increases apace, until it finally becomes deep bronze-brown, the color of a mulatto. This pigmentation, however, is generally not uniform, but a particularly dark tint is exhibited by all those parts of the body which normally possess a deeper pigmentation than the rest of the skin: the face, neck and hands, nipples, and genitals; furthermore there occur, as a rule, besides the general coloring scattered over the entire surface of the body, darker spots here and there which are not sharply demarcated, but gradually blend with their surroundings.

The nail-beds and conjunctivæ always remain uncolored, which of course produces a conspicuous effect by contrast.

On the other hand, the mucous membrane of the mouth and pharynx often participates in the discoloration, grayish spots being formed which occasionally exhibit a slight bluish tint. These spots, as a rule, develop by preference at points indented by the teeth.

This affection of the mucous membranes and the scattered occurrence of darkly pigmented spots on the skin, of course aside from the general symptoms, would furnish a differential diagnostic landmark from the diffuse increase of the cutaneous pigment which sometimes occurs in otherwise healthy persons, and which likewise occasionally produces an intense brown pigmentation of the whole surface of the body.

The anatomical examination of the skin has shown a very great augmentation of the epidermal pigment, and in the more pronounced cases also numerous aggregations of pigment granules in the cutis, especially in the papillary body. Otherwise no changes have been found in the skin

### MACULÆ CÆRULEÆ.

Clinicians have long been acquainted with a peculiar exanthem described under the name of tâches bleues, ombrées, or as pelioma typhosum, by Trousseau and Griesinger,[1] and which had usually been interpreted as a symptom of typhoid fever. Lewin ascertained that this exanthem stood in no relation with syphilis, as had originally been believed.

In 1868, Falot and his pupils Guiol, Jaquemin, and Moursou, discovered the connection of these peculiar spots with the presence of phthirii; this discovery has since been confirmed by numerous observations, as for instance by O. Simon,[2] but especially by Duguet,[3] who succeeded in producing this exanthem experimentally.

These maculæ cæruleæ appear as roundish or oval spots, ranging in size from a lentil to a quarter dollar and often larger, of a reddish-blue or peculiar dull, dark-blue color; they are not elevated and do not disappear on pressure. They are confined usually to

[1] Comp. also Liebermeister, this Cyclopedia, Vol. ii.

[2] Brest. ärztl. Ztschr., 1881, No. 14.

[3] Annal. de Derm., 1880, p. 544; 1881, p. 357, and Comptes rend. des Séanc. de la Soc. de Biol., 1882, p. 617.

certain regions, particularly to the anterior and lateral parts of the abdomen, the sides of the thorax, the anterior and inner surface of the thigh, the nates, more rarely the back, the arms, and legs. In no case in which these spots are present will the search for crab-lice be in vain, or the history will demonstrate that the patient has removed the pediculi previous to the examination. The arrangement of the spots, too, around the localities forming the usual habitat of the phthirii points to the above-mentioned causal connection. This becomes still more evident by the fact that the spots remain exactly on the roads the pediculi travel from one favorite locality to the other; *e. g.*, on the anterior and lateral portions of the trunk between the inguinal region and the axilla. Still more convincing is the observation that in persons having phthirii in one axilla only, maculæ cæruleæ are present on the corresponding side of the thorax alone. Positive proof has been furnished by Duguet (l. c.), by rubbing some crab-lice to a paste with water, charging a lancet with this, and puncturing the skin of different persons. On these places there appeared most promptly—not earlier than six hours—maculæ cæruleæ which differed from the natural ones in nothing but the small excoriation in the centre caused by the puncture.

Inoculations with ova were always negative, and the last experiments of Duguet have shown that the coloring principle is most probably contained in the salivary glands situated in the segment of the body of the animal bearing the second pair of legs.

Although it is absolutely certain, therefore, that the maculæ cæruleæ are due to the presence of phthirii on the skin, and most probably to the bite of the animals, still the real nature of the process is by no means clear. It is certain that the spots are not simple hyperæmias or hemorrhages, because they behave altogether differently from the changes wrought by those processes. A certain predisposition seems to be necessary to their occurrence, inasmuch as they are not exhibited by all persons infested with crab-lice. Duguet's inoculations, too, succeeded in all cases only with persons who had maculæ cæruleæ before the inoculation. In such as had no crab-lice, and of course no maculæ, the inoculation succeeded only in isolated cases. The former, therefore, were predisposed and if invaded by phthirii would have been the only ones to show maculæ. As a general rule, blond persons with delicate skin usually exhibit this symptom.

I have been induced to give this detailed description because in none of the text-books have I found a correct explanation of this subject. Finally I must guard against being accused of interpreting this affection as an alteration of the real pigment of the skin. For the present, we are still completely in the dark as regards the actual pathological process, and it is considered in an appendix to pigment hypertrophy merely as a temporary make-shift.

## PIGMENT ATROPHY.

Pigment atrophies, of course, are most conspicuous in the colored races, and most of the earlier descriptions refer to them; until recent times even the occurrence of partial pigment atrophies in the white races has been totally denied by some authors. In Germany v. Bärensprung[1] first classified them in the manner still prevailing at the present day. The latter erects three groups—albinismus universalis partialis and vitiligo; the former two comprising the congenital, the latter the acquired pigment atrophies. It must be added, however, that the morbid pictures on which Bärensprung bases this classification do not fully accord with what we understand nowadays by these terms. For the cases

[1] "Ueber Vitiligo und Albinismus partialis." Deutsche Kliuik, 1855.

described by him as albinismus partialis are most probably cases of vitiligo in the present acceptation, and his cases of vitiligo were cases of that very rare cutaneous disease known as morphea, or sclérodermie en plaques.

For the present, therefore, we distinguish two groups, congenital and acquired pigment atrophies; the former of which is again subdivided into two classes, according as the pigment atrophy implicates the entire surface of the body or merely circumscribed portions of the skin—leucopathia congenita s. albinismus universalis and partialis, and leucopathia acquisita s. vitiligo.

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The best known of these three anomalies is albinismus universalis; if for no other reason, because those affected with it present a most striking appearance even to the laity. Those affected with this anomaly are altogether free from pigment, their skin is perfectly white (albinoes), only here and there it acquires a reddish tint from the more or less perceptible blood-vessels. All the functions of the skin are quite intact; it seems that even other diseases of the skin run the very same course as in normal persons.

The hairs likewise are either white or have a peculiar light whitish-yellow color, with a silky lustre, and are usually of remarkable fineness. The iris is colorless, appearing red in consequence of the visible blood-vessels. Still not very rarely the iris appears blue, but even then only in side view; but if the albino's eye meets the eye of the observer, the blood-vessels gleaming through impart a red color to the iris. However, the blue color of the iris is not due to pigment, but is nothing but a phenomenon of interference of light. The lack of pigment of the iris in albinoes induces photophobia and nystagmus.

The majority of albinoes are of a weakly constitution, but this rule is by no means without exception.

The anatomical examination of the skin shows no alterations except an absolute absence of pigment, which has been demonstrated in the skin, in the choroid, and in the pigment layer of the retina.

We know of but a single etiological factor—heredity. Direct inheritance, however, seems to be very rare, for in the majority of observations we find it particularly emphasized that the parents of the albino were normally pigmented. Schlegel[1] cites a case in which this anomaly was transmitted from the grandfather to the grandchild. Another fact, however, proves quite indubitably that the infantile organism is affected by an anomaly of the progenitors, which indeed is still unknown to us—namely, the fact that brothers and sisters are albinotic with extraordinary frequency; nay, more, that the occurrence of but a single albino among many children of the same parents must be called strictly exceptional. I know of a family in which six children are albinotic, and one normal. Moreover, the statement that albinism prevails endemically in certain localities, as in Loango and Lower Guinea,[2] might have to be taken into consideration here, should it be confirmed; for in a disease which is not contagious and not caused by external influences, its endemic occurrence, of course, can be explained in no other way than by hereditary transmission.

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[1] "Ein Beitrag zur näheren Kenntniss der Albinos." Meiningen, 1824.

[2] Eble: "Die Lehre von den Haaren." Vienna, 1831, p. 167.

### *Partial Albinism.*

It is generally conceded that this is met with in the colored races, but its occurrence in Europeans is denied by many. However, there is no doubt that this congenital partial lack of pigment in whites is by no means very rare, though we do not intend to deny that this anomaly may perhaps be more frequent in the colored than in the white races.

We have to deal now with that congenital lack of pigment of isolated parts of the skin which presents itself in the form of white spots, generally with irregular border, the skin of which is otherwise perfectly normal. They are limited either by normally pigmented skin, or else they are surrounded by a zone containing less than the normal amount of pigment, so that the transition is gradual. In no case is the skin immediately adjoining the white patches more strongly pigmented than normal. In short, partial albinism forms in every respect a perfect analogue—the "reverse side," as Kaposi happily expresses it—of the congenital flat pigment moles. Indeed, to complete this analogy still more, we even know of cases in which the congenital pigment atrophy, exactly like the pigment hypertrophy in nævi of the nerves, accurately corresponds with the distribution of some nerve. I subjoin here the description and illustration of a very pronounced case of this nature.

Fig. 35.

Anna K——, æt. 19, came under treatment for soft chancre. The wood-cut renders any further description of the pigment atrophy unnecessary. It corresponded exactly to the distribution of the hypogastric branch of the ileo-hypogastric nerve.[1] Corresponding to the conditions prevailing in herpes zoster and the nævi of the nerves, the whole region of the nerve is not unpigmented, but within it are portions of normally pigmented skin, especially on the outer side. The transition into the normally pigmented skin is not quite abrupt, but a more faintly pigmented zone everywhere surrounds the non-pigmented spots. Besides, the patient presented a second pigment atrophy on the right side of the neck, in the shape of a triangle, the base of which corresponded to the line between chin and jugulum, and its apex about to the middle of the sterno-cleido-mastoid, where the skin, though not altogether unpigmented, was still evidently less strongly pigmented than the surrounding parts. This latter spot corresponds to the distribution of the N. subcutaneus colli med. et inf. derived from the third cervical nerve. Both alterations existed from birth.

In the case of a girl dead of phthisis, who had a similar congenital pigment atrophy on the right side of the abdomen, I have been enabled to examine the skin anatomically,

[1] v. Bärensprung: "Die Gürtelkrankheit," p. 88.

and to demonstrate complete absence of pigment only in the central portions, while at the periphery there was a gradual transition into the normally pigmented skin.

Special attention should also be given to the color change of the hair. Very frequently, though not always, the hairs on the unpigmented spots are likewise white. Thus, in the above-mentioned case, the hairs on the non-pigmented skin of the right half of the mons Veneris were white. But cases are by no means rare in which some bunches of hair are white from birth, while the skin bearing them shows no noticeable lack of pigment. Of course, the capillitium at these points appears somewhat lighter as compared with the portions set with darker hairs.

This phenomenon has been frequently described as poliosis circumscripta, and unquestionable cases of inheritance of this pigment anomaly have been observed. Thus, Seligsohn[1] describes a white ringlet on the anterior part of the head of four brothers. Still more important is the communication by Stricker,[2] according to which a white lock on the forehead was inherited in one family through six generations. In this instance direct inheritance only was observed, reversion of the defect of the grand-parents not occurring in the children of healthy parents. Sex made no difference as regards the transmission.

### LEUCOPATHIA ACQUISITA S. VITILIGO.

The term vitiligo is now applied merely to acquired pigment atrophy.

The disease occurs mostly in middle age, and manifests itself first in the shape of small, regularly round, white spots. These white patches gradually increase in size and lose some of their regularity of outline. They become more oval, and irregular white figures arise particularly by the confluence of such spots. But even in the case of large spots due to the confluence of several circles or ovals, this mode of origin can generally be demonstrated with great distinctness. For the limiting lines are always convex toward the outside, while the skin remaining pigmented is accordingly bounded by concave lines. In this way, finally a large portion of the skin, and in the most advanced cases almost the entire skin, may lose its pigment.

Now, while the partial pigment atrophy is evidently the original pathological process, still the surrounding parts exhibit quite noteworthy alterations, which sometimes are even more conspicuous than the former. In the surroundings of the white spots there ensues an increase of pigment, which becomes progressively more intense as the white patches enlarge. The impression conveyed is exactly as if there were a continuous displacement of the pigment in a centrifugal direction.

Of course, by this pigment accumulation at the periphery, the contrast between the non-pigmented and the pigmented places is correspondingly intensified as the former enlarge, and finally, when the entire pigment, as it were, is crowded into isolated small islets, these small spots appear deep brown in color, while the rest of the body is white. Sometimes these pigmented islands are situated at the most peripheral parts of the body—in the face, at the hands and feet. It is these cases especially which have given rise to the very natural mistake that the brown places are really the abnormal ones—a mistake which is rendered impossible by the observation of many cases in the different stages, or by the observation of the progressive development in a single case.

Another very remarkable phenomenon is this, that the decolored patches usually

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[1] Eulenburg, "Realencyclopädie," Bd. i., p. 162.

[2] Virchow's Arch., Bd. 73, p. 623.

occur symmetrically. In this way are produced quite peculiar markings, as appears most clearly in the adjoining illustration.

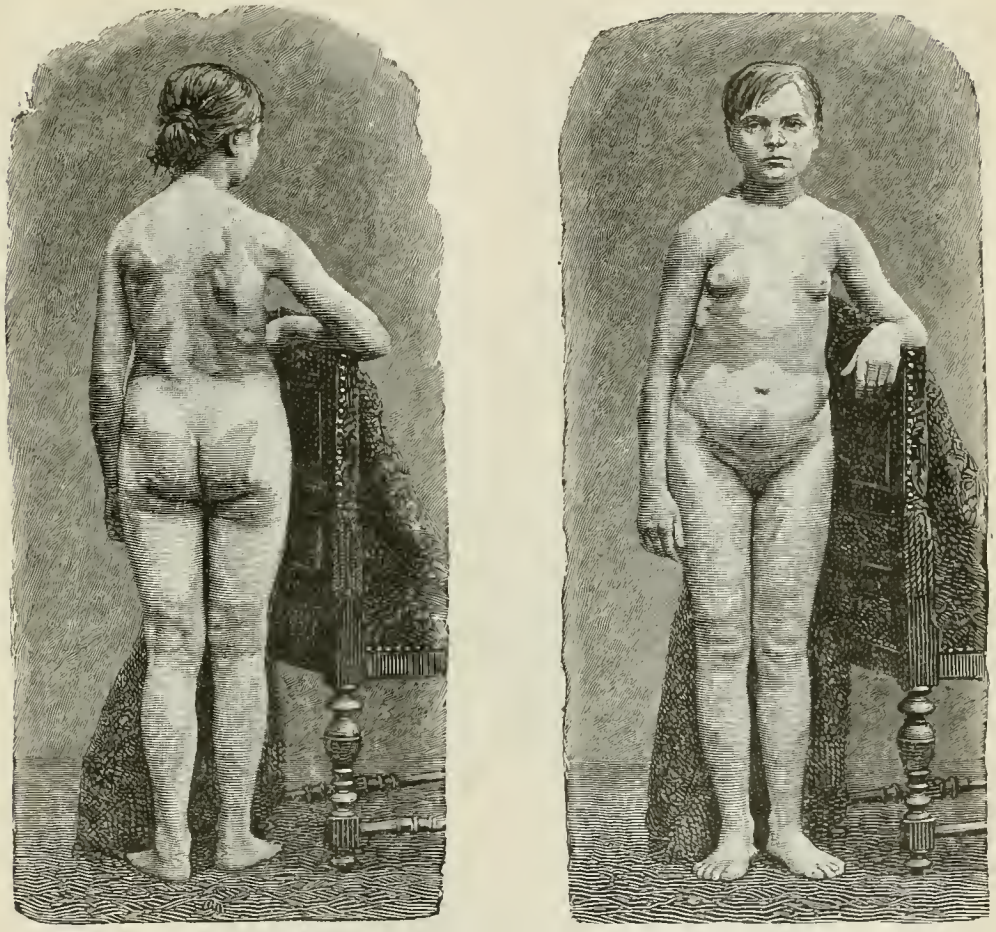

Fig. 36.

Ida P——, æt. 16, was admitted to the clinic with syphilis. More than a year ago the patient had an attack of remittent fever. Soon after, the decoloration commenced with a white spot at the nucha. Till that time the patient had a light-colored skin, while from that period forward the not decolored portions became even darker, some of them at present being deep brown. The almost exactly symmetrical arrangement of the decolored places is evident in the illustration. The limits everywhere are quite sharp, the darkest pigmentation of the colored parts is exactly at the border. At the occiput is a bunch of white hair about one centimetre in diameter.

I call to mind here the fact that, in a large number of cutaneous diseases, the efflorescences appear symmetrically arranged, and that this peculiarity is due pre-eminently to the circumstance that the anatomical relations of the skin—by no means uniform throughout this organ as a whole—are perfectly equal on symmetrical regions, and hence, of course, afford an equal basis to any morbid process affecting them. It is most reasonable to ascribe to this fact also the symmetrical spread of the unpigmented spots in vitiligo, and not to connect them with the distribution of the nerves.

No other disturbance in the cutaneous activity takes place.

The participation of the hairs in the process of decolorarion has been mentioned above. This complication is exceedingly frequent, there being found in nearly every case of extensive vitiligo either isolated bunches of decolored hair, or else white hairs are irregularly scattered among the pigmented ones. Sometimes decoloration of the hair is met with also in slightly advanced cases; thus I have observed a case having but a single white spot on the trunk, several smaller ones on the hands, and one, about the size of a dollar, on the head, covered with white hairs. Now and then, however, the leucopathy is confined to the hairs, an occurrence which we might term poliosis circumscripta acquisita.

I append here the illustration and description of a most characteristic case of this nature.[1]

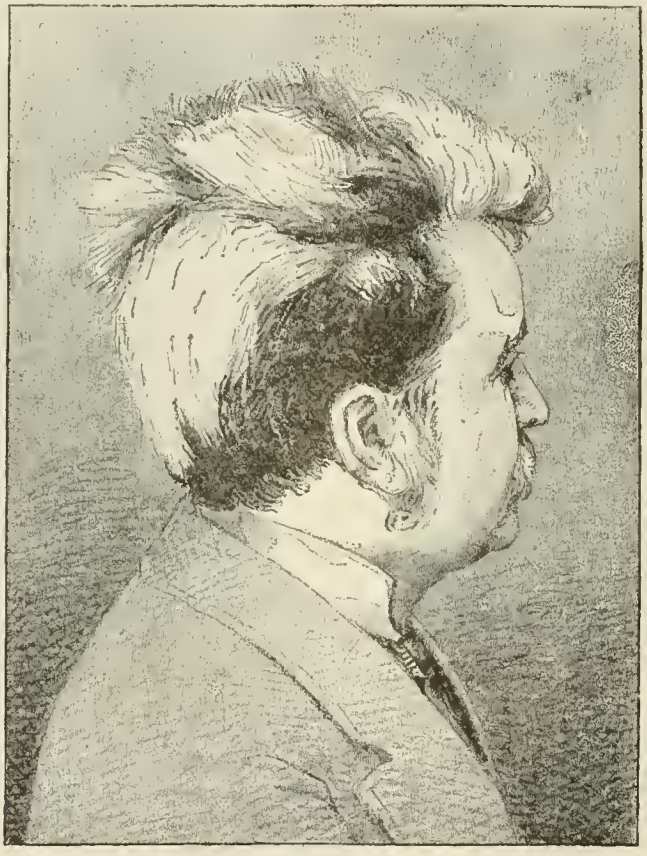

Fig. 37.

M——, barrister, æt. 23. In the family of both parents there is stated to be congenital canities præmatura. Some white hairs have been observed in patient even in childhood. In the fifteenth year, after a grave attack of scarlet fever, the hair fell out to a great extent. The succeeding growth of hair is stated to have been throughout lighter in color and fissured at the points. Soon afterward, a bunch of white hairs appeared on the occiput. In the succeeding years, small patches of decolored hairs were noticed also on the anterior and lateral portions of the scalp. In the spring

[1] I am indebted to the kindness of Dr. Michelson, of Königsberg, for the history and illustration of this case.

of 1880, infiltration of the apex of the right lung; of late years, violent headaches, never lasting longer than half a day, chiefly manifesting themselves in pressure within the orbits. Otherwise subjective feeling of health. Present condition: Patient is of stout build; nothing abnormal in the internal organs except some dulness over the apex of the lung. Complexion delicate throughout. Eyebrows and lashes dark-brown. Moustache and whiskers blond, in the latter a few small groups of white hair. The skin containing them is considerably lighter than the surrounding parts; there is no accumulation of pigment or even darker coloration of the periphery. The scalp is covered with numerous scales; its color throughout is uncommonly light. The parts covered with decolored hairs are clearly less pigmented than their surroundings, but this contrast is certainly enhanced by the visibility of the follicular portions of the dark hairs. There is no sharp demarcation of the vitiligo spots from the adjoining parts bearing brown hair. The localization of the decolored patches is shown by the illustration; they are chiefly on the left half of the head. The hairs growing on them are nearly quite unpigmented, but otherwise normal and firmly inserted into the scalp. The skin of these patches, aside from the decoloration, is perfectly normal. At the nucha there is a small spot beset with white hairs; on the rest of the body, in part amply supplied with hair, no perceptible absence of pigment anywhere. The patient states that his head never sweats.[1]

It is true, we have to emphasize certain deviations from the general type of acquired leucopathy—the absence of the sharp demarcation and of the increased pigmentation of the regions around the unpigmented spots. But we find the same deviations, too, in those decolorations of the hair occurring simultaneously with vitiligo of the rest of the skin, and we are justified, therefore, in ascribing them to variations in the development of the affection produced by the peculiar localization. I hold it to be altogether unquestionable that these cases owe their origin to the same morbid process as the vitiligo.

The course of vitiligo is progressive, the white spots steadily enlarging, so that they finally may occupy the entire skin.[2] But the pigment atrophy may also stop at any point and remain forever stationary. Näcke[3] states that in a case observed by him—this was an auto-observation, and we may therefore all the more exclude any deception—the white spots at one point became again normally pigmented, while they remained unpigmented on the rest of the body and presented absolutely the characteristic aspect of vitiligo. But this behavior is exceptional; the spots once having lost their pigment, generally remain permanently white. The disease has not the slightest influence on the functions of the skin nor on the general health of the affected person.

I have examined three cases anatomically; in two, the vitiligo was an accidental discovery at the post-mortem, while in the third, a piece of skin was excised during life. I can only confirm Simon's statements, that the skin presents nothing abnormal but absolute absence of pigment in the decolored spots, and more or less intense pigment hypertrophy in the darker portions. Remarkable appeared to me only the very large quantity of pigment in the corium, especially where the brown parts adjoined the white

The etiology of vitiligo is rather obscure, still some facts which have a bearing upon it can be established. There does not seem to be any greater disposition of one or the other sex, but age has a decided influence. In the large majority of cases it begins between the tenth and the thirtieth years; much more rarely later, and quite exceptionally earlier. I know of but two cases in early life—the above-mentioned case of Näcke, in which the disease began in the fifth year, and another commencing in the eighth year. In many instances the onset succeeds some acute disease; thus, in the cases detailed above

[1] This must be regarded as an exception, the absence of any further disturbance of function in the decolored parts having been otherwise regularly observed.

[2] Lévy (Recueil de mém. de méd., de chir. et de pharm. mil., 1865, p. 193) has seen three cases in which the pigment diappeared completely.

[3] Berl. klin. Wochenschr., 1881, p. 523.

once after remittent fever, and once after scarlatina. Others have also observed vitiligo after typhoid fever. This concurrence is so frequent relatively that we cannot look upon it as merely accidental. I have seen two patients in whom pruritus preceded the occurrence of vitiligo spots. In isolated cases the affection is stated to have started from a cicatrix,[1] and indeed I have seen in a joiner, who exhibited on the rest of the body a vitiligo in the ordinary form and arrangement of the white spots, numerous white patches situated on the dorsum of the hand and the flexor surfaces of the forearms, of irregular, not round form, within which there were, at least in part, smaller and larger cicatrices. The patient stated that the disease had commenced at the scars on the hands and arms, due to injuries suffered while working at his trade. But we still lack any explanation how these processes lead to this peculiarly localized pigment atrophy, and on the other hand to the pigment hypertrophy existing at other points.

The diagnosis, in the majority of cases, will be very easy, only we must not forget that we can place very little reliance on the statements of the patients. It is for this reason that I thought myself justified in interpreting as vitiligo some of the cases described by Bärensprung as partial albinism, because the only point on which that diagnosis was based was the statement of the patients that the spots had existed from earliest infancy, while the description of these cases corresponded exactly with the former disease. The differentiation from partial albinism, however, will nearly always be easy even without the aid of the patients' statements; for mistakes are guarded against by the regularly round form of the original patches and the likewise quite characteristic markings produced by their confluence; and by the mostly symmetrical arrangement, and especially the great accumulations of pigment at the borders which are never absent when the decolored portions have attained a certain size. All these peculiarities are absent in partial albinism; the forms are not regular, there is no symmetrical arrangement, and the transition into the normal skin is often effected through an intermediate, very slightly pigmented zone; at all events there is never any accumulation of pigment at the margin. Of other diseases, only morphœa and leprosy might have to be considered. The former is distinguished by the scar-like quality of the affected parts; and the white spots occasionally occurring in leprosy show a slight desquamation which never takes place in vitiligo, and besides, a decrease in the sensibility can always be demonstrated in them.

The prognosis appears as a natural sequence from what has been stated above, and our treatment is altogether powerless. Only in cases where the white portions have spread so far that between them nothing but small brown islands are present, we can remove, at least for a time, the resulting disfigurement, by dispelling the pigment of these brown spots according to the methods given above, and thus produce uniformity. But even here the effect is of but short duration, and after some time the pigmentation reappears in its former character.

### PIGMENT ATROPHY AFTER SYPHILIS, PIGMENT SYPHILIS.

A secondary pigment atrophy comes under observation in a series of cutaneous diseases, but in this place I intend to discuss only the pigment atrophy after syphilitic efflorescences. Perhaps the majority of observers are inclined to deny absolutely the existence of a typical "pigment syphilis."

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[1] Hebra: "Lehrbuch," Bd. ii., p. 128.

In the first place, I intend to give here a brief description of the alteration in question, and afterward discuss the other publications relating to this matter.

Early in the secondary period, usually after the disappearance of the first exanthem, there occurs in many syphilitics—by no means in all, and, I may say here, almost exclusively in women—a peculiar discoloration of the skin, particularly on the neck, frequently also around the axillæ, in rarer cases on other parts of the skin. The impression first conveyed by these places is that of an almost net-like brown marking, but by comparing many cases, it becomes altogether unquestionable that the characteristic feature is the occurrence of round or oval light spots, ranging in size up to that of a quarter dollar, situated on a more or less strongly pigmented background. It is especially those cases in which but few such white spots are present that leave no doubt as to the correctness of this interpretation. Here, on a skin but slightly more pigmented than the normal, we see isolated white spots up to one centimetre in diameter, which are separated by interspaces three or four times as large. In the majority of cases, however, the white spots are much more closely aggregated, at the same time the pigmentation of the intervening portions of skin increases in intensity, so that a brown network first strikes the eye, and the interspersed light places appear normal. But comparison with the first-described cases, and observation of the development of this discoloration, proves that in these latter, too, the original pathological element is the occurrence of the decolored places, that the increased pigmentation around them is but secondary, and rests on the same displacement of pigment which we have become familiar with in vitiligo. In the latter disease, likewise, similar mistakes have actually been made, and the brown spots have been considered the original morbid process. True, the brown spots are not normal either, but their increased pigmentation can be looked upon only as secondary, due to the pigment atrophy of the other spots.

This mistake of assuming the pigmented places to be the originally affected ones has been made by the majority of observers. Although later observers have described the affection quite correctly, their conception is always that the pigmented spots represent the actual pathological process. That this error may lead to incongruities is shown by the fact that Fournier[1] describes pigment syphilis quite correctly in the text; he compares the confluent brown places to a coarse-meshed lace, and speaks of a possible confounding with vitiligo, and still, in the plate appertaining thereto (Pl. VIII.), the relation is depicted quite falsely, brown spots being represented surrounded by a light network. In another point, however, I fully coincide with Fournier, namely, that the decoloration in the lighter places is not complete, that they are not quite white, but merely light as compared with their darker surroundings, for they are found regularly at points which are normally usually darker in color thn the remaining skin, particularly on the neck.

Quite in harmony with my conception, however, are the description and illustration of pigment syphilis in the work of Henry Fox,[2] who accordingly terms the affection leucoderma post syphilidem.

The question whether we have to deal here with an independent syphilitic exanthem deviating from the ordinary forms, or merely with the sequels of a cutaneous eruption coinciding with the well-known syphilitic efflorescences, I think I can answer with Schwimmer in the latter sense. Observation has shown that the light spots appear at the points

[1] "Leçons clin. sur. la syph." Paris, 1881, p. 326.

[2] "Photogr. Illustr. of Cut. Syph." New York, 1881, p. 55, Pl. iii., Fig. 2.

formerly occupied by syphilitic papules; hence I assume, even for the cases in which this process had not been observed directly, that the decoloration is effected corresponding to the absorption of syphilitic infiltrations. I would call to mind here an obviously similar process in the absorption of psoriatic efflorescences after the employment of chrysarobin, where light spots likewise appear corresponding to the former seat of the psoriatic patches which become doubly conspicuous by the darkening produced by the chrysarobin on the surrounding parts. Another point in favor of this view is the pronounced intractability of pigment syphilis. In spite of all imaginable antisyphilitic courses of treatment, the affection persists one or two years, disappearing quite gradually, even without being treated.

Herein, then, lies the exceedingly great diagnostic importance of pigment syphilis. In many cases, in which all other distinct manifestations are often absent, within the first years of the syphilitic diathesis it furnishes an absolutely certain proof of the presence of the disease, and its value is only enhanced by the easy accessibility of the parts usually affected. And as the occurrence of pigment syphilis, at least in women, is relatively frequent, I hold it to be a new, exceedingly important diagnostic landmark.

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We now enter on the consideration of those anomalous colorations of the skin produced by foreign coloring matters. These may be introduced into the skin either by the blood-vessels from within, or penetrate mechanically into it from without. In the former way is effected the icteric coloration of the skin and argyria; in the latter, those due to tattooing and the introduction of gunpowder.

The icteric color of the skin is produced by the impregnation of the skin with bile pigment which takes place whenever the blood, from any cause, contains this substance which is not normally present in it. Of course, the skin shares this fate with all other tissues of the body, at least in so far as they are not very deficient in blood and lymph vessels. According to the quantity of bile pigment passing from the blood into the skin, the intensity of the color varies from a light yellowish tint to an intense yellow, yellowish-green and olive-green, and even still darker, blackish-green shades in the gravest chronic forms of icterus, and these have given rise to the names icterus viridis and melas. The saturation of the skin with the pigment is at first quite diffuse, only if the icterus is of very long standing it is possible to demonstrate by the microscope here and there some small, angular greenish-yellow particles. The most disagreeable symptom, next to the discoloration, and often more annoying than the latter, is the often occurring pruritus, evidently produced by the direct irritation of the nerve terminations in the skin by the bile pigment.

Argyria is produced by the introduction of silver into the intestine and its transportation by the blood into the various organs of the body. The symptom of this disease, which is of the greatest importance to us in this connection, the discoloration of the skin, shows itself first by a dull, steel-gray or faint bluish color appearing earliest in the face and on the hands, that is, on the uncovered parts of the body, where it also attains the greatest intensity subsequently, when the entire skin has been implicated. When, with the continued introduction of the drug, the alteration increases in intensity, the color becomes darker, and may finally acquire a deep grayish-blue. This discoloration is usually participated in by the mucous membranes, as that of the mouth and conjunctiva, also by the nails, though in a slighter degree. The hairs, too, acquire a peculiar reddish color, as, for instance, in persons dyeing their hair with solutions of silver nitrate.

Microscopic examination of the skin shows that the epithelial portions, the rete mucosum, also the glandular epithelium, are altogether free from depositions of silver. On the other hand, throughout the connective tissue portions of the skin there are accumulations of the finest granules of silver. These deposits of silver are the most dense immediately beneath the epidermis in the uppermost layers of the papillary body, and in the membranæ propriæ of the sweat-glands, where they form a continuous strip, of a violet appearance under low powers. In like manner we find more or less extensive deposits of silver in all internal organs, with the exception of the central nervous system.

These phenomena appear only either after the very long-continued use of silver nitrate, or after a shorter employment of very large doses. Hence, as a rule, we have to deal with patients who have taken silver nitrate internally for years because of chronic affections of the nervous system, tabes, epilepsy. Another mode of origin of argyria is reported by Neumann,[1] the case of a physician affected with ulcer of the stomach, who, for several months, injected two to three times daily into his stomach, by means of the œsophageal sound, a solution containing about 1.5 gm. of silver nitrate. After about twelve doses, the first indications of the discoloration are said to have appeared. Furthermore, cases of argyria have been observed after the very long continued applications to the pharynx or tongue, such as is often employed for years especially by hypochondriacs, evidently in consequence of small quantities of the remedy being swallowed.

Attempts have been made repeatedly to produce argyria artificially in animals by long-continued feeding with silver nitrate, but thus far always with negative results as regards the skin; in some internal organs of these animals silver could be demonstrated.

Opinions are still divided as to the chemistry of the processes taking place therein. Reimer's view[2] appears most probable; he assumes that the silver, having been reduced in the intestine, and being in the state of finest subdivision, is taken up by the chyle vessels, thence transported into the blood current, and then deposited in the vaiours organs. It is difficult, however, to bring into harmony therewith the influence of light on the staining of the uncovered parts, which is indisputable in view of the clinical observation, for the color of the reduced silver can no longer be altered in any way by the light.

In the present state of our knowledge, argyria must be considered an incurable affection. Neumann[3] alone reports that, in a case under his observation, according to the statement of the patient, the intensity of the stain decreased in the course of several years.

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Finally, there remains the consideration of the color changes of the skin due to the mechanical introduction of substances from without.

The procedure, of course largely modified in its details, consists simply in outlining with a fine needle the desired design by closely adjoining punctures, then firmly rubbing into the skin thus prepared the pigment in question, indigo, powdered carbon, cinnabar, carmin, with which occasionally the needle may also be charged, and finally applying a bandage over the part. The particles of pigment which have thus penetrated

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[1] Medic. Jahrbücher, Bd. iii., p. 369, 1877.
[2] Arch. d. Heilk., Bd. xvi., pp. 296 and 385.
[3] Arch. d. Heilk, xvi., p. 382.

through the minute wounds beneath the epidermis into the corium remain there and undergo no further alterations, so that the design produced by them persists forever.

Tattooing is of interest to the physician really only in so far as repeated infections with syphilis have occurred in consequence of the habit of moistening the needle employed with saliva so as to make the pigment adhere.

The numerous attempts to utilize tattooing of the skin for the purpose of covering annoying pigmentations, in the case of nævi, etc., have unfortunately not been crowned with success, while, as is well known, tattooing of the cornea in opacities of that structure is often employed with advantage.

A similar effect is produced by the penetration of minute particles of carbon from powder burns, which in part are made intentionally with the same object as that of tattooing, in part are accidental, as in gunshot wounds, etc.

The color presented by these carbon particles through the skin is not a pure black, but has a distinct bluish tinge, probably due to the portions of skin overlying them.

In workmen, too, who have much to do with coal, miners and firemen, who are also largely exposed to injuries by falling pieces of coal, we often find small particles of carbon sprinkled into the skin which appear bluish-black, exactly like the granules from powder burns.

# ANOMALIES

OF THE

# SEBACEOUS GLANDS AND THEIR FUNCTION.

BY

ERNST VEIEL, M.D.,[1]

OF CANNSTATT.

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Imbedded in the several layers of the skin, we find a series of organs which represent invaginations of the epidermis into the corium. These blind tubes—sacciform or tubular formations—are the sweat-glands, the hair-follicles, and the sebaceous glands or follicles. While the sweat-glands represent deep-seated convolutions of tubes which, situated in the corium, penetrate it in gentle spirals, but traverse the epidermis in diminishing, cork-screw-like twists and always terminate by themselves, the hair and sebaceous follicles form virtually but one organ. The sebaceous glands belong to the class of acinous glands; in their simplest form, they occur as unilobular or bilobular, grape-like sacs, or else multilobular, mulberry-like (in the capillitium, on the nose, scrotum, etc.), and terminate in one efferent duct, together with a hair-follicle, or apparently alone. In the latter case, we find almost invariably small (atrophic) hair-sacs, with downy hair (lanugo), as lateral appendages, which either remain hid in the efferent duct of the sebaceous gland or project from the pore. Sebaceous glands and hair-follicles are organs appertaining together; they are either equally developed, in which case the efferent duct of the sebaceous gland terminates in the hair-follicle while still within the cutis, the sebaceous gland appearing as an appendage of the hair; or else, as on parts scantily supplied with hair, the hair formation is merely rudimentary, so that the small atrophic hair-follicle represents an appendage to the fully developed sebaceous gland and its efferent duct. The efferent duct of such a sebaceous gland is identical with the uppermost part or with the terminus of a hair-follicle. On perfectly hairless parts, we are forced to assume an absolute atrophy of the accompanying hair-follicle.

[1] When the esteemed author died, on January 7th, 1883, the manuscript for this chapter was found completed, with the exception of the sections on "Acne rosacea" and "Sycosis," the writing of which Dr. Th. Veiel was kind enough to undertake.

Both sebaceous glands and hair-follicles represent sacs surrounded by vascular networks; their interior is invested with epithelial cells arranged like those of the epidermis. The uppermost cells, forming the interior lining of the sac, are degenerating epithelial cells infiltrated with fat globules.

In the normal state, the cavity is filled with an oily, greasy mass, the cutaneous fat; the latter, under the microscope, is seen to consist of cast-off cells (either whole and filled with fat granules, or ruptured), of free fat globules, and crystals of cholesterin.

This greasy mass is frequently occupied, particularly at the ala nasi and the auricle, by a small, eight-legged, certainly quite harmless parasite, the acarus folliculorum. Chemical examination shows the principal constituents to be, approximately, five per cent of fat, together with water, an albuminoid substance, and in the ash chiefly earthy phosphates (Funke).

The *vis a tergo* and the contraction of the arrectores pilorum muscles, which are not subject to will-power, must be held to be the forces discharging the formed secretion. The more fluid the consistence of the sebum cutaneum, the less will the discharge of the secretion require the action of these forces.

As to the anomalies of secretion, we have to deal either with an increased formation (seborrhœa) or with a more or less diminished elaboration (oligosteatosis and asteatosis). In seborrhœa, the sebum is sometimes of normal consistence, sometimes it is unusually fluid or firm.

The disturbances of excretion, on the whole, are nothing but retention of the secretion (retention tumors, Virchow), occurring either in the gland proper or in its efferent duct, or in both, from narrowing or blocking of the opening. With the last named disturbances, of course, both the glands and the efferent channels are subject to manifold alterations; while in seborrhœa the glands and ducts, or at least the former, are not affected. If the efferent duct is merely mechanically occluded by the hardened secretion, there occurs the comedo with its sequels. Retention of secretion through contraction or obliteration of the efferent duct produces milium (sive grutum) or atheroma, according to the seat of the contraction, whether near the opening or deeper in the gland.

The contents of these three forms are at first nothing but the normal secretion of the glands and their efferent channels (sebum, epidermis, etc.); subsequently, however, they may be so altered by the admixture of inflammatory and degenerative products (serum, pus, blood, etc.), and by entire or partial absorption, that the "original character of the contents is altogether lost" (Virchow).

To these fundamental forms of disease it will be best to add the discussion of some dermatological morbid pictures which essentially represent a combination of the above morbid processes—viz., acne simplex, acne rosacea, and acne mentagra or sycosis.

The frequent participation of the hair-follicle and the hair in these forms of acne as well as in the elementary forms of disease of the sebaceous glands is self-evident.

## A. ANOMALIES OF SECRETION.

### 1. HYPERSECRETION: SEBORRHŒA, STEATORRHŒA, ACNE SEBACEA, ETC.

An excessive quantity of the sebaceous secretion, liquid or solid, comes to the surface of the epidermis or between the hairs, the skin remaining unchanged, excepting the occasional occurrence of some dilatation of the opening of the sebaceous glands. The disease is most frequent in the young and may occur on all parts of the body excepting those not supplied with sebaceous glands.

According to the state of the secretion, whether more fluid, oily, or more firm and even dry, we speak of a seborrhœa oleosa or a seborrhœa sicca; but the scales or crusts, even if apparently quite dry, always contain fat. The drying of the exuded sebum cutaneum is probably due to a relatively larger amount of water contained therein, with subsequent evaporation. Both forms may exist side by side on the same individual, and also transitional forms between them; it is more appropriate, therefore, to divide seborrhœa according to its location. Accordingly we distinguish a general and a local seborrhœa.

*a. Seborrhœa Universalis.*

Every child is born with a quasi-physiological seborrhœa, with a covering of vernix caseosa, the sebaceous secretion accumulated during intra-uterine life; but after a few days the skin loses the tendency to increased elaboration of sebum. Quite different from this are the cases described under the name of seborrhœa universalis neonatorum, in which, after removal of the vernix caseosa, the whole body is covered with a deep red, glossy skin, looking as if it were varnished (Kaposi). Unless the bared skin is immediately covered with some grease, it becomes fissured, particularly around the mouth and anus. After some time the red skin is again invested with a sebaceous coating which, unless covered with moist or greasy rags, rapidly dries into hard fissured crusts. As a rule, the children succumb to their painful affection, after a short time, from asthenia. However, in these cases, described as seborrhœa universalis, it is certain that we are not dealing with a seborrhœa, but with an affection resembling ichthyosis, as is shown both by the diagnostic factor, that in seborrhœa the skin covered by it is normal, and by the unfavorable prognosis. Of general seborrhœa in the adult, to the best of my knowledge, there is on record only a single case described by Biett. Finally it should be noted that whole races (*e. g.*, the negroes) are affected with a physiological seborrhœa universalis.

*b. Seborrhœa Localis.*

*Seborrhœa of the hairy scalp.*—In children it appears as a continuation and desiccation of the vernix caseosa which forms thin, firmly adherent crusts, colored more or less deep brown to black by atmospheric impurities. On removal of the firmly attached crusts, the underlying skin is found slightly macerated, covered with a thin, smeary coating of sebum having a rancid odor, similar to a part of the body which has for some length of time been covered with a rubber plaster or caoutchouc. If the disease be not interfered with, the crusts crumble to pieces in most cases after a longer or shorter time.

No other symptoms or sequels are to be noted, excepting, perhaps, at first a slow growth of hair.

In adults the disease appears in various forms, dependent on the nature of the secretion. In seborrhœa oleosa capillitii, the hair is continually greasy and smeary, forming a constant deposit of dust and impurities. Rapid desiccation of the oily secretion leads to agglutination of the hair into larger or smaller bunches.

Dry seborrhœa capillitii presents various appearances: where the formation of epidermis predominates, the scalp and hair are filled with glossy, white, flaky, sometimes flour-like scales, pityriasis capitis; if there be a greater admixture of sebum, a glossy white deposit is formed on the scalp; if the secretion be still more fatty—the most frequent condition—the scales, partly firmly attached to the capillitium, partly free between the hairs, are more yellowish, often stained by dirt, and have a greasy feel. As additional symptoms

might be mentioned, a lustreless and dusty appearance of the hair and often very considerable loss of it; where the crust is thick, an increasd feeling of warmth; and where the skin is very irritable, sometimes slight itching. Often the scalp has a peculiar mouldy smell.

Where the secretion has become ragged and rancid, the seborrhœa capillitii may be complicated with dermatitis and eczema.

The duration is very variable, often lasting several years. Spontaneous recovery is not rare. The causes are unknown. Chlorotic and anæmic conditions, especially after grave and constitutional diseases, predispose thereto; it is probably for this reason that the female sex predominates among these patients, aside from the fact that wearing the hair long discloses very slight cases of seborrhœa which would be overlooked in men. Blond persons are most disposed to the dry, brunettes to the oily form of this affection.

*Seborrhœa of the face*, likewise, must be divided into seborrhœa faciei sicca and oleosa. The favorite localities are those possessing the greatest number of sebaceous glands. Here, too, the skin is normal, excepting that in a number of cases, especially on the nose and cheek, the openings of the efferent ducts are dilated. It is sometimes hyperæmic in the dry form and the patient has an itching, burning sensation.

Seborrhœa oleosa (preferring the nose, cheek, eyelids, and forehead) occurs almost exclusively in the young and dark-complexioned, and imparts to the affected localities an oily or fatty gloss; all attempts at cleanliness are in vain, barely an hour after the grease has been soaped off, the face shines as before. Where the excretion is slower or consolidates more rapidly, the skin is colored by atmospheric impurities, yellow, dark, to almost blackish.

Duhring describes a special form of seborrhœa oleosa nasi, in which the nose, the skin of which is reddened and exhibits dilated openings of the sebaceous glands, has an oily appearance and feels cold, a vaso-motor paralysis.

The dry form of facial seborrhœa, which is as frequent in older persons as in the young, and which often occurs as an immediate sequel of the variola eruption or after the recovery from grave cutaneous syphilides and other exhausting diseases, covers isolated parts, seldom the whole of the face, with a more or less thick and dirty mask of crusts, which always has a greasy feel even in the completely dry form. On detaching the crusts, they are seen to present on the side next to the skin a number of small, needle-like processes, spurs of dried secretion, corresponding to the dilated openings of the glands. The small processes, soft at their extremities, are formed like comedones and are composed chiefly of fatty enchyma cells and a few horny cells.

In ordinary cases the skin is barely reddened; but as the crust becomes drier and greasier, the redness increases and the epidermis becomes thinner and more vulnerable, bleeding easily; at the same time, however, the disease ceases to be seborrhœa and merges into the slighter forms of lupus erythematosus. These cases, in which at times one really does not know what diagnosis to make, have been named by Hebra "seborrhœa congestiva."

Dry seborrhœa of the face is often complicated with comedones and acne; such patients exhibit a tendency to the formation of comedones on other parts of the body.

Transition into eczema of the face, too, is not rare.

*Seborrhœa corporis.*—The sternal region, the interscapular region, the umbilicus, and the genitals are also favorite seats of seborrhœa. Seborrhœa of these parts exhibits no special peculiarity; that of the umbilicus and genitals has a pronounced tendency to provoke dermatitis, even eczemas, owing to the ready decomposition.

The *diagnosis*, except in the case of transition forms into other affections, such as eczema or lupus erythematosus, offers no difficulty. The underlying skin presents absolutely no anatomical alteration; it shows, at most, slight hyperæmia and quite superficial maceration of the uppermost corneous layers of the epidermis. Some forms of seborrhœa may be confounded, on superficial examination, with eczema; still, in such cases of eczema, vesication and dermatitic symptoms being absent, the course of the affection, the history (seborrhœa does not weep at any time), and the much greater permanent itching, which is hardly ever lacking in eczema, will facilitate the diagnosis.

Some forms of seborrhœa sicca may also be mistaken for psoriasis. But the thick, white, dry scales of the sharply circumscribed psoriatic patches, as compared with the relatively thin, very rarely pure white, always greasy-feeling, and indistinctly outlined spots of seborrhœa, will prevent error.

Seborrhœa of the sternal region often simulates herpes tonsurans, but the microscope soon clears up the doubt.

Really difficult and sometimes impossible is the diagnosis between some types of seborrhœa sicca s. S. congestiva and lupus erythematosus, particularly as both show a predilection for the nose and cheek. However, in most cases of lupus erythematosus there is present the membranous, dry, not fatty, shagreen-like, chalky, characteristic crust of epidermis, after the detachment of which a bleeding raw surface is left; while in seborrhœa sicca the crusts can be seen and felt to be thicker and more fatty; and when removed, they leave behind, as a rule, a scarcely reddened portion of skin, with merely dilated openings of the sebaceous glands.

The *prognosis* in seborrhœa is generally favorable, but often a long time elapses until complete recovery ensues; the restoration of the growth of hair gives rise not infrequently to considerable solicitude and calls for thorough treatment. I have seen some cases of seborrhœa oleosa which resisted all treatment.

*Treatment.*—The first is the causal indication: in chlorosis, preparations of iron, appropriate diet and regimen, etc. Chronic gastric affections require appropriate treatment. There are no specifics, although Duhring mentions, for some cases, arsenic in the form of the wine of arsenic.

While the general treatment combats the tendency to seborrhœa, often with success, the external applications remove mainly the present symptoms. The external treatment fulfils three indications: 1st, softening and removal of the secretion; 2d, alteration of the skin by the production of an artificial dermatitis; 3d, after-treatment, partly with astringents, partly with irritants, so as to prevent the recurrence of seborrhœa. Should it reappear nevertheless, the cycle is repeated at appropriate intervals; this is especially the case in pityriasis capillitii, with great loss of hair. The first object—softening and removal of the secretion—is best obtained by fluid or semi-solid fats or glycerin, as well as by mixtures of these; the addition of water is desirable, in proportion as the secretion abounds in epidermis. Any further admixture of drugs is unnecessary. Usually, oil or vaseline, or mixtures of equal parts of both, will suffice. In our clinic, we employ a mixture of olive-oil with the hydrated unguentum rosatum of the German pharmacopœia:

℞ Ung. rosat.,
Ol. olivar., . . . . . āā part. æq.
M. ft. unguentum.

Duhring recommends mixtures of glycerin and water or alcohol (1 : 4). To the scalp the emollient mixture is applied by being rubbed in with the hand and brush. At night, the head is covered with a night-cap or hood. In the face, the detach-

ment of the crusts is attained most rapidly by a mask of strips of lint or flannel smeared with vaseline or the ointment; excellent results are obtained also by a mask of Unna's lead-plaster mull; either kind of mask is changed every twelve hours, kept in place by bandages of gauze, and applied only after the crusts have been moistened with oil or glycerin.

The crusts having been detached and softened (usually in one or two days), and the skin cleansed of fat and remaining crusts by means of warm water and soap, we enter on the second part of the treatment—the alteration. For this purpose we employ almost exclusively green soap in substance, applied three times daily to the parts affected with seborrhœa until a moderate dermatitis ensues. This usually consumes three days. Should the dermatitis become too violent, and acute eczema appear here and there, the soap infrictions are suspended, but the soap is not washed off until three days have elapsed since the first inunction. In the female sex the liquid soaps are preferable; the best of these are the fluid glycerin soap of the Vienna court pharmacy, or Hebra's alkaline spirit of soap:

℞ Saponis viridis, . . . . . 200 parts.
Spiritus, . . . . . 100 "
Misc. diger. filtra et filtrato adde
Spiritus lavendulæ, . . . . . 20 " and more (or
Spir. serpyll. thym., etc.)
S. Alkaline spirit of soap.

Where the hair-follicles participate largely in the seborrhœa (falling of the hair), the latter form is always to be preferred to either of the former. When the soap is washed off, the skin is reddened, the epidermis glossy and tense, slightly fissured, and desquamates as after scarlatina. While on the first day after washing off the soap it is not desirable to apply grease, mild ointments—ung. leniens or rosatum, with or without the addition of zinc, as well as Wilson's benzoated zinc ointment—may be employed from the second day on, according to the degree of the cutaneous irritation.

In place of the soap, metallic ointments—proto-iodide of mercury ointment, ung. Rochardi, etc.—may also be employed ; but their use, to say the least, is unnecessary.

As soon as the skin is clear, the third indication has to be met : preventing the recurrence of the seborrhœa. This is done by the application of astringents and irritants, always best in alcoholic solution. Kaposi proposes carbolic, boracic, and salicylic acids ; of the former, 0.15 gram ; of the latter two, 3 grams in 100 grams of alcohol. We employ, with excellent results, a five-per-cent alcoholic solution of chloral hydrate, twice daily. Others extol petroleum, capsicum, cantharides, etc., with alcohol or in the form of an ointment. The addition of glycerin, but not above ten per cent, or the occasional application of oil or pomatum, prevents the skin or hair from becoming too dry.

Of astringents, tannin may be recommended in solution, or as a pomatum in seborrhœa capillitii.

℞ Acidi tannici, . . . . . 10 grams.
Ung. pomat. sive rosati, . . . . . 100 "

Piffard recommends tannin and chloride of iron in solution, the former also in powder. The pomades of extract of cinchona likewise belong under this head. Where there is great loss of hair, I frequently employ the following pomade.

℞ Extr. cinch. frig. par., . . . . . 1.5 grams.
Bals. peruvian, . . . . . 1.0 "
Tinct. canth., . . . . . 1.5–2.5 "
Succ. citri, . . . . . 1.0 "
Ung. pomatini, . . . . . 50.0 "
S. To be rubbed into the scalp once or twice daily.

In the above method of treatment, I have taken for granted that the patient can devote himself entirely to the treatment; but a different management will be required if the patient does not wish to neglect his business on account of it. The frictions with oil are made in the evening, the grease being removed from the face or hair in the morning, by rubbing with a dry cloth. In place of the soap, liquor potass. carbonat., pure or diluted with from one to four parts of water, according to the sensitiveness of the skin, is applied to the face morning and evening. The white floury appearance of the face after the employment of this remedy ceases with a slight inunction of vaseline. In very slight cases, daily softening and detachment of the crust, with subsequent washing, suffice. But in seborrhœa of the genitals it is advisable to dispense with fat, ointments, and frequent ablutions. Three daily ablutions with lead water, aqueous solution of carbolic acid (1 : 100), as well as the six-per-cent copper solution recommended by Kaposi (ærug., 0.15 gram; aq., 25 grams), followed by dusting with starch, have done me the best service. Quite recently, I have completely cured a similar case of seborrhœa complicated with frequent balanitis, by covering both glans and prepuce with Unna's zinc rubber-plaster muslin.

In the grave form of seborrhœa neonatorum, in ichthyosis sebacea, the child must be completely wrapped in greased rags and fed artificially, as it cannot nurse on account of the rhagades.

### 2. *Diminished or arrested Secretion, Oligo-steatosis, Asteatosis.*

Diminished or arrested secretion of sebum occurs only as a concomitant of certain groups of symptoms in which the perspiration likewise is diminished or arrested. This combination leads to extraordinary dryness of the skin with detachment of dry scales of epidermis (pityriasis), and fissuring at points of flexion and extension. This symptom manifests itself with physiological, senile, and with pathological atrophy of the cutis; also with excessive formation of epidermis, with ichthyosis. Both diseases are also described as xeroderma.

A slighter degree of defective secretion of sebum occurs in psoriasis, lichen ruber, and prurigo.

The lack of fat can be compensated for only by supplying fat to the skin, by applications of greasy substances the consistence of which resembles most closely the natural secretion (vaseline, cold cream, etc.).

Mention should perhaps be made of artificial asteatosis in domestics, laundresses, photographers, and others, although the secretion of sebum is not disturbed therein, but the excreted fat is at once dissolved again by alkalies, alcohol, ether, etc. Still, when this has continued some length of time, the secretion must suffer some alteration, because even if the former occupation be abandoned, several weeks of regular cultivation of the skin are often necessary to restore the normal activity of the sebaceous glands.

## B. ANOMALIES OF EXCRETION.

### RETENTIO SEBI.

The anomalies of excretion are, as above stated, merely retentions of the sebaceous secretion in various grades and stages of development: comedo, milium, and atheroma.

#### 1. *Comedo.*

The term comedo is used for accumulations, in the efferent ducts, of hardened sebaceous secretion which was either produced in a too solid condition or dried up and hardened in consequence of defective discharge, appearing in the dilated openings as a dark (bluish) or even black point.

The comedo projects above the level of the skin; it varies in size from the point to the head of a pin. The favorite locations of this affection, besides the face, are the breast, the nucha, the back, and the genitals. If pressure be made from two sides, there appears a yellowish-white, vermiform structure the upper part of which is cornified (flesh-worm).

Comedones constitute a disease of youth, especially the time of puberty, but they are likewise frequently met with at a later age; the male sex is more commonly affected; blonds are more prone to it than brunettes.

There is hardly a single person in whom a comedo could not be found; it is merely the number and size of the black points which disfigure or annoy, especially if complicated with seborrhœa, which is not rarely the case.

Usually the comedo stands isolated, but occurs also in groups; in the latter case, each single one projecting slightly above the level of the skin, a verrucose conglomeration of comedones is formed.

The inspissated sebum generally forms a cylindrical plug filling the efferent duct which farther inward, corresponding to the sebaceous gland or hair-follicle, dilates into a bag or flask shape, and usually terminates in a soft point. This small body is inclosed in a membrane, a closely packed layer of flakes of epidermis which incloses several similar ones, but not so solid, in concentric arrangement. Between them lie the contents of the sebaceous glands, enchyma cells in good preservation and in the various stages of fatty degeneration, free globules of fat, plates of cholesterin, detritus, lanugo hairs, and not rarely one or more parasites (Demodex or Acarus folliculorum). The latter, barely visible to the naked eye, provided with six or eight legs, and approximately of the same shape as the comedo, occurs also in normal sebaceous glands without a comedo, and bears no causal relation to any affection of the sebaceous glands. The black head of the plug is produced by the retention of all sorts of atmospheric impurities.

Three factors may contribute to the formation of these plugs: 1. The secretion may be too firm; 2. it may dry on account of the excretion being too slight and tardy, and the *vis a tergo* lacking in consequence; 3. nervous influences may impair or arrest the second expulsive power, the activity of the arrectores pilorum. Biesiadecki and Kaposi assume that the lanugo hairs, emerging at about half a right angle to the axis of the efferent channel of the gland, continually irritate the opposite wall of the duct and thus produce an increased proliferation of cells, which would explain the structure of comedo.

Of the general causes leading to the formation of comedones we only know the above states of general debility producing weakness or paralysis of the nerves: chlorosis, anæmia, disturbances of important bodily functions, *e. g.*, of digestion, menstruation, glandular activity (scrofulosis). They are not due to excesses *in Baccho et Venere*, onanism,

etc. A local cause is occlusion of the opening of the efferent duct by dirt, uncleanliness, and drugs (tar).

The termination of a comedo is either spontaneous recovery by expulsion of the plug when the discharging forces are restored, or inflammation and suppuration (acne).

Under this head belong also the ectasias of the efferent ducts of the sebaceous follicles described by Küstner as white comedones which occur in the shape of white points on the nose and around the mouth of the new-born ; they are more numerous in proportion to the earliness of the fœtal period. They are transition forms of milium, open milia.

*Treatment.*—Removal of the sebaceous plug, which is done without pain or injury by lateral pressure with two fingers ; but the latter must be wrapped with linen, otherwise the epidermis is easily bruised off (Hebra). Piffard and others have devised special blunt instruments resembling a saddler's awl, comedo expressors ; but every watch-key answers as well. The traumatic dermatitis arising from it is best combated with iced lead-water applications.

After the skin has again become normal, the sebaceous glands, etc., have to be stimulated into increased activity for some months ; the best means for this purpose are, twice daily soaping, rinsing, and vigorous rubbing with a rough towel, or sea-baths. But all sorts of irritants are employed as a wash : Liq. potas. carbonat., also solution of corrosive sublimate, at first stronger, later more dilute, and borax and sulphur ointments.

### 2. *Milium.*

Isolated whitish, rounded granules, often of a pearly lustre, usually the size of grits or millet-seeds, generally projecting hemispherically above the skin, covered only with epidermis. The favorite sites are those parts most amply provided with sebaceous glands, more especially where the skin is thinnest ; in other words, where the efferent ducts are the shortest. While comedo is more a disease of youth, milium is most frequent in persons of middle age.

A milium is situated in the same layer of the cutis as the sebaceous gland ; above the follicle there is either a thin portion of the cutis or else the epidermis merely is intact.

Milium shows no tendency to inflammation, but may remain unchanged for years, and causes no subjective symptoms.

Behind the occluded mouth of the efferent duct of the sebaceous gland, which may be closed either at the opening or through its entire extent, the secretion accumulates in the sebaceous or hair follicle, where it forms a round or lobulated body.

Similar to the comedo, it represents an organized body : around a point situated at the centre or external to it are formed a number of concentrically arranged, progressively enlarging membranes. The pearly lustre is probably due to this arrangement.

Sebum, partly or entirely degenerated epithelium, free fat, and small hairs, are situated between these lamellæ, consisting of firmly apposed epithelia. When the sebum is largely fluid, a yellowish translucent body is formed, meliceris. A microscopic section shows that the lamellæ, septum-like, divide the small tumor into segments.

Causes of the occlusion of the mouth of the sebaceous follicle are : 1. Those of comedo and atheroma, for this opening may be closed by any comedo, the irritation of the wall leading to inflammation around the efferent duct, and then, by cicatricial contraction, to obliteration of the mouth or of the efferent channel (Virchow). 2. A traumatic or other cicatricial formation. Recently I saw the formation of milia occur in an otherwise quite intact cutis and epidermis, within five or six weeks after a superficial abrasion of

the cheek; it seems the obliteration affected all the openings of the sebaceous glands within the abraded area. 3. The occlusion may be congenital.

*Diagnosis.*—It is impossible to confound this affection with any other, excepting perhaps xanthoma palpebrarum; however, sufficient differential characteristics will be furnished, on the one hand, by the more pronounced yellow color and the more plate-like appearance of xanthoma which presents a sharply demarcated roundish form, as well as by the absence of the pearly lustre; on the other hand, by the fact that xanthoma is generally confined to the eyelid; moreover, on grasping a fold of skin, milium feels like a foreign body, xanthoma does not, and when the epidermis is slit open, in milium the spherical body is easily expressed, but not in xanthoma.

The *treatment* of milium consists in its removal; usually it is sufficient to make a small incision, often bloodless, with a lancet into the tense epidermis, when a gentle lateral pressure will cause the globule to emerge. The minute wound at most requires to be covered with court-plaster. In order to prevent relapses, the skin should be soaped and rubbed at least once a day.

In acute multiple formation of milia which, however, I have never yet met with, Kaposi advises frictions of green soap.

### 3. *Atheroma.*

*Steatoma, Sebaceous Cyst.*

Slightly rounded or hemispherical tumors, ranging in size from a lentil to a hen's egg and in firmness from elastic softness to tense hardness, covered with normal, often glossy distended skin.

Atheroma, an accumulation of sebum either in the sebaceous gland proper or in the hair-follicle, has its seat partly in the cutis, partly in the subcutaneous cellular tissue.

It is met with most frequently on the hairy scalp, in the face, on nucha and back, and on the genitals. The efferent duct of the sebaceous gland is either occluded or remains normal; cases of stenosis of the duct likewise occur.

Closed atheromata are found on the scalp and in the face (most frequently on the eyelids); those with open follicular ducts on the nucha, back, and the labia majora, but neither of these forms is exclusively confined to these places. According as the efferent channel is open or closed, the tumor feels soft and doughy, or elastic and tense. The variation in size is extreme, according to the duration of the retention, which may comprise a few weeks to a number of years. The skin extended over an atheroma of the scalp is hairless. The hair-follicles seem to be atrophied from pressure. From the open atheromata of the back and nucha the pulpy contents are evacuated on pressure. Atheroma occurs almost always isolated, very rarely in groups. Buch mentions twenty-three cysts from a pin's head to a pea in size, on the glans penis, after an infection with a soft chancre. In rare cases the walls inflame, and spontaneous recovery by suppuration ensues, sometimes also absorption of the fluid constituents, with thickening and calcification. As a rule, atheroma is painless.

There is no doubt that these sebaceous cysts are produced in the same way as comedones and milia. This explains also the fact that the accumulations have their seat at times in the sebaceous gland, at times in the hair-follicle. One or other of these structures has in the course of time been changed by pressure into a sac of connective tissue of variable thickness, the inner surface of which is covered with a membrane consisting of accumulated epithelia and corresponding to the normal investiture of the dilated organs as well as to the lamellæ inclosing milia and comedones. This lamellar sac is the true

product of the inclosed thinner or thicker, granular pulp, usually turned rancid by the length of time. By far the greater part of this pulp consists of epithelia, the lesser part of fat, partly still inclosed in the epithelia, partly free. The presence of epidermis gives to these cyst-contents the characteristic pulpy form. The fat is either of an oily nature or cholesterin. When the latter predominates, the pulp acquires a glistening appearance. The admixture of lanugo is not lacking. In some cysts, probably transition forms into milia, the onion-like structure peculiar to the latter has been found.

The *diagnosis* is usually very easy. It can at most be confounded with lipoma; where any doubt remains, an exploratory puncture will decide.

The *treatment* is exclusively surgical, the complete extirpation of the entire sac being the best. Simple opening or partial extirpation is of no use, for even small remnants of the investing membrane give rise to new cysts. An easy method which generally suffices is the following:

Immediately at the margin of the tumor a straight incision, somewhat longer than the diameter of the tumor, is made. Thereby the border of the sac is exposed and it is easy to insinuate a dull spoon underneath the tumor and thus loosen and enucleate it.

Should extirpation be impossible, the sac must be opened and emptied, and its inner surface destroyed by some caustic; this is necessary, too, if small remnants have been left behind after attempted extirpation.

## *Acne simplex.*

### *Acne, Acne vulgaris, Acne disseminata.*

By acne in the more restricted sense, or acne simplex, we understand an inflammatory process, generally chronic, of the sebaceous glands with the formation of nodules and tubercles, in the centre of which is a black comedo plug or a pustule.

The single acne efflorescence arises usually without any demonstrable cause from a comedo which changes to a red nodule with a black centre (acne punctata). The latter in a few days develops into a pustule with a variably intense inflammatory areola (acne pustulosa) and after the comedo plug is discharged, it heals without leaving any cicatrix. But if the inflammation is not restricted to the follicle and its efferent duct, and the surrounding cutis tissue takes part, then the inflammation, in the majority of cases, passes into suppuration and smaller or larger abscesses form; they open and lead to suppuration and destruction of the sebaceous glands as well as of the connecting hair-follicle, and leave cicatrices. If the abscess is small, the cicatrix resembles a pockmark; larger abscesses leave larger cicatrices. Larger abscesses have a tendency to burrow, and the contractions and distortions lead partly to cicatricial cords, partly to narrow folds with the formation of pockets.

In these cutaneous remnants the sebaceous glands exhibit a strong tendency to form comedones and milia so that these pockets are often quite dotted over with black points. The pain manifested with this process corresponds to the degree and the extent of the inflammation. Another course of the inflammation, usually painless, is the chronic type leading to the formation of nodules (acne indurata) which, however, may subsequently suppurate.

The number of acne pustules and nodules simultaneously present is very variable, from a few to several hundred. However, as but few sebaceous glands inflame at the same time, all stages of development will be found side by side on the same person.

Acne is very frequently complicated with other affections of the sebaceous glands;

with seborrhœa of the head, face, and neck, with milium, and in the higher degrees of the disease, with atheromatous processes. The complexion of the face is frequently grayish dirty; comedones, pustules, crusts, and nodules are oddly intermingled on a bloated, grayish skin with fatty lustre. In very grave cases, though fortunately much more rarely in the face than on the back and nucha, there occur also atheromatous follicular tumors whose efferent ducts are nearly always preserved, and pressure on which evacuates first a gigantic comedo plug and then the above-mentioned rancid white pulp. The back of such patients has a rancid odor differing specifically from the usual exhalation.

In acne punctata the papillæ and the upper layer of the cutis are the seat of inflammatory changes. In the slighter cases of acne punctata, suppuration is found only in the efferent duct; in nodules and abscesses, the connective tissue surrounding the glands and hair-follicles is inflamed, with subsequent purulent degeneration. The more deeply the suppuration penetrates, the greater is the succeeding destruction of the sebaceous glands alone or the sebaceous and hair follicle. In acne abscesses, both must perish.

The *cause* of the inflammation is the mechanical irritation by the inspissated secretion; the latter again is due to deficient glandular activity, because, owing to the defective elaboration of sebum, the secretion has time to dry in the efferent duct. Behrend explains the continued new-formation of acne efflorescences by assuming that the swelling of the inflammatory areolæ around existing acne pustules and nodules occludes the efferent channels of additional, heretofore healthy glands. By this swelling he also explains the occasional occurrence of pus deep in the follicles, while the efferent ducts are apparently intact. Acne simplex occurs chiefly during and after puberty, from the fourteenth to the thirtieth year.

Kaposi states that the male, Wilson that the female sex is more predisposed to acne.

In our clinic, of eighty-three acne patients, fifty-one were males. On the other hand, the female sex predominates before, the male after the thirtieth year of life. Hebra found equal frequency in both sexes. Chronic digestive disturbances, anæmic and chlorotic conditions seem to predispose to acne. Auspitz repeatedly saw acne appear after variola. The fact that acne occurs at the time of puberty has caused excess and lack of sexual intercourse, onanism, and insomnia to be looked upon as etiological factors. Excessive habitual consumption of alcoholic beverages or of pungently seasoned dishes are not causes any more than the others. Still, acne seems to have some connection with the genital sphere, for often it appears only during pregnancy, or ceases during that period; on the other hand, eunuchs are very rarely subject to acne.

The following forms or varieties should be distinguished from this idiopathic type:

1. *Acne frontalis s. varioliformis* (Hebra), nodules and pustules appearing in groups at the edge of the scalp. The nodules are brownish-red and contain no comedo. The flat pustules often dry in the centre, and the minute crust then sinks below the level, thus producing an umbilicated, pock-like pustule which leaves a scar after the falling of the crust. The course of this form differs from that of ordinary acne by the simultaneous appearance of a larger number of efflorescences and an intermission of several months between these outbreaks.

2. *Acne cachecticorum* (Hebra) occurs over the whole body of debilitated persons; this form exhibits flat, dirty-red nodules changing into pustules which leave pigmented scars. I take it to be a grave form of acne due to anæmia.

Both forms, acne frontalis and acne cachecticorum, are very rare and bear the

greatest resemblance to syphilis pustulosa, and nothing but the history and further course will clear up the diagnosis.

3. *Acne artificialis s. medicamentosa.* In this form, the sebaceous glands inflame in consequence of the external or the internal influence of drugs. Among these are:

*Tar acne.* Owing to the irritation of the glandular efferent duct by tar, whether by direct application to the skin or by continued inhalation of tar vapor, there are formed, particularly on the extensor side of the extremities (more frequently with hirsute individuals), hard red nodules, with or without pustulation, whose centres are occupied by a black point consisting of tar particles and epidermis, in the midst of which there is often a fine hair. More frequently than in ordinary acne, there are formed hard nodules having a brawny feel which are usually very painful and on delicate portions of the skin sometimes develop into furuncles. After the use of tar is discontinued, the acne slowly disappears, often after the lapse of a month; the levelling of the nodes is materially accelerated by pulling the hairs. Resineon, creasote, and petroleum, when applied to the skin for a lengthened period, may likewise produce acne. To the same category belongs also the acne observed in flax spinners.

*Chrysarobin acne.* This drug possesses the quality of irritating the sebaceous glands into the formation of acne; only in this instance nodules are developed even more frequently than in tar acne; the nodules have a black dot in the centre.

The internal use of drugs may produce: *iodine acne.* This appears first in the face (forehead), often within a few days and usually simultaneously with iodine catarrh. The nodules are small, and quickly change into pustules with a vivid red areola which, according to T. Fox, may develop into a ring-shaped vesicle. The exanthem appears simultaneously and has an acute course, leaving no scars. Acne is the slightest of the iodine exanthemata; in graver forms, the exanthem may be vesicular; in still more violent intoxication, it may be hemorrhagic (Thin). With the continued use of iodine, the drug was shown to be present both in the normal sebaceous secretion and in the pus of the acne pustules. Hence iodine acne is a consequence of the local irritation of the sebaceous glands by excreted salts of iodine.

*Bromine acne.* The continued use of bromine salts (bromide of potassium and sodium) causes a deep inflammation of the sebaceous glands—bromine acne. Though bearing the greatest resemblance to ordinary acne, it leads to much deeper infiltrations and abscesses. Bromine acne differs from acne simplex by attacking the hairy parts by preference; its occurrence on the scalp is especially characteristic; it increases or diminishes with augmented or lessened doses of bromine. In bromine as in iodine acne, the excretion of the drug by the sebaceous glands is the cause of their irritation and inflammation, and the bromine has been demonstrated in the pus of the bromine acne pustules by Guttmann, while my brother, Th. Veiel, has been unable to detect it in them.

All these drug exanthems disappear spontaneously when the remedy is discontinued. Bromine acne moderates considerably after only ten days; after three weeks it is gone. Iodine acne disappears even more rapidly.

*Diagnosis.*—Acne may be confounded with pustular syphilides and varioloid. From the former it may be differentiated by the history and the inoculability; from varioloid, by the fever associated with this eruption, by the course, and its occurrence on the whole body, the extremities included. In the forms of artificial acne, comedones develop but rarely, if at all.

*Treatment.*—Artificial acne is mastered by removing the cause, and the levelling of

the tubercles is hastened by withdrawing the centrally located hairs. Idiopathic acne, however, is a stubborn affection to be conquered only by great persistence. The internal treatment is to be directed only against anæmic and chlorotic conditions possibly present. Laxatives and so-called blood-purifiers, sarsaparilla, etc., are of no value, perhaps even aggravate the trouble.

The external treatment has for its object the removal of the acne nodules and pustules, and as far as possible the prevention of their new-formation. In order to attain the former end, the pustules should be opened so as to give free egress to the pus. For this purpose we employ a narrow lancet or the conical pyramidal awl devised by Auspitz, which is passed along the efferent duct as far as the pus cavity. Others endeavor to accomplish this object by painting the pustules with concentrated carbolic acid, followed by a coating with flexible collodion. Any comedones present are expressed, those inflamed into papules are caused to mature by covering them with emplastrum cinereum, with Unna's mercurial plaster muslin, or else by irritant frictions. For the latter, the most frequent applications are, Hebra's alkaline spirit of soap and liquor potassæ carbonat., or iodate of mercury ointments 1 : 10, iodide of mercury ointments 1 : 20, and unguentum Rochardi.

℞ Hydrarg. chlor. mit., . . . . . 1.5 Gm.
Iodi puri, . . . . . 0.5 "
Leni igne fusis adde
Ung. rosat., . . . . . 70.0 " .
M. f. ung. S. To be rubbed in three times daily.

Compresses wet with solution of corrosive sublimate 1 : 100 (extreme caution !) and painting with iodized glycerin, the parts being subsequently covered with rubber cloth, are also used for the same purpose. For acne of the trunk Hebra recommends Vlemingkx's solution. All these applications lead to the development and maturing of the acne efflorescences preformed in the skin. The first-named method, covering with emplastrum cinereum, though it requires a little more time, is painless, and hence to be preferred to the others. Not until further development of papules is no longer manifested should slightly irritant spirituous lotions be employed, so as to stimulate the glandular activity. Of such, the sulphur paste recommended by Hebra for sycosis occupies the first rank ; but in order to prevent the possible irritation of the eyes by sulphur particles dropping into them, mucilage should be added to it. I use the following formula :

℞ Lactis sulphuris,
Alcoholis,
Aquæ rosarum, . . . . . āā 30 Gms.
Mucil. acaciæ, . . . . . 10–20 "
To be applied every three hours.

If this sulphur paste cannot be continued day and night until recovery has ensued, *i. e.*, until fresh inflammations of the sebaceous glands no longer appear, the tension and burning of the reddened rough skin of the face by day must be moderated by greasing with some simple fat (vaseline), to be rendered less conspicuous by powdering subsequently. It is of advantage also to use for the same purpose a mixture of benzoin and water, with the addition of glycerin.

℞ Tinct. benzoin, . . . . . 5 Gms.
Aq. rosarum, . . . . . 90 "
Glycerini, . . . . . 5 "
To be applied two or three times daily.

I order this lotion for months after the cure is completed, as a toilet water stimulating the activity of the skin.

Instead of the sulphur paste, many autnors recommend an aqueous, alcoholic solution of corrosive sublimate 1 : 400–500. Ellinger most warmly recommends rubbing with sand which, however, has been formerly used in a different form, as sand-soap and pumice-soap.

In the case of deep seated abcesses it is advisable to scrape the lesion with a curette.

# ACNE ROSACEA AND SYCOSIS.

BY

TH. VEIEL, M.D.,

CANNSTATT.

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## ACNE ROSACEA.

*Definition.*—Patches of bluish or copper-colored, rarely lighter erythemata of the skin, with or without visibly dilated blood-vessels and acne efflorescences, mostly confined to the face, especially the nose, cheek, chin, and forehead, and having a chronic course.

Acne rosacea has been included among the diseases of the sebaceous glands because the affection of these glands often comes prominently into the foreground. This disease of the sebaceous glands, however, is merely accidental; the affection is due to vascular dilatation and on this account Auspitz has correctly incorporated the disease among his angio-neurotic dermatoses.

To understand this disease, we must bear in mind these facts: that there are present in the skin two plexuses of vessels situated parallel to the surface of the epidermis, the deeper one of which extends where the corium merges with the subcutaneous cellular tissue; the superficial one, under the papillary layer. The communication between the two is effected by means of a series of arteries and veins which give off the branches enveloping the follicles.

As a rule, the congestive hyperæmia begins in the deeper plexus and in the vessels enveloping the follicles. Owing to its deep situation, this congestion is perceptible merely as a diffuse redness, while the dilatation of the several vessels is not noticeable. This diffuse redness forms the first manifestation of the disease and generally appears first on the nose, particularly the alæ nasi, then on the cheeks and chin, but in the beginning only temporarily with fluxions toward the skin (after eating, after partaking of stimulating beverages, with mental excitement, or the influence of irritants [heat, cold]), and is conjoined with a subjective feeling of warmth. Gradully the vascular dilatation becomes permanent, in the course of months and years it slowly spreads peripherally, during warm temperature it exhibits a light red, during cold seasons a more bluish-red color, and is never associated with desquamation of the skin. Owing to the implication

of the blood-vessels enveloping the follicles, a seborrhœa oleosa is often superadded. This, the slightest form of acne rosacea is observed especially in young females.

In the further course, inflammation and suppuration of the follicles frequently supervene, as in acne. The hyperæmia extends to the superficial vascular plexus; on the erythematous base, dilated venous branches become visible even to the naked eye, and scattered between them acne nodules and pustules (second degree).

In the third degree, finally, new-formation of connective tissue, hypertrophy of the cutis supervenes. The latter occurs either as a uniform hypertrophy of the nose and swelling of the skin of the cheek, or else there appear circumscribed tubercles in the form of hemispherical or lobulated, even pedunculated, clapper-shaped (Hebra) fleshy excrescences covered with skin which is either normal or provided with extensively anastomosing vessels. The mouths of the sebaceous glands are dilated; pressure upon the nodules evacuates rancid semi-solid sebum. The nodules have either a firm or an elastic feel. A nose embellished with such excrescences may acquire an extraordinary size. Hans Hebra has recently (*Archiv f. Dermat. und Syph.*, 1881) described and figured such a rhinophyma; but he believes that rhinophyma, as an independent disease, is to be separated from acne rosacea. My brother extirpated about forty of these excrescences from the nose of a colleague and found, like Biesiadecki, Hans Hebra, Piffard, Rokitansky, and Gustav Simon, that they consist partly of firm, partly of embryonal, gelatinous connective tissue, dilated blood-vessels, and enlarged sebaceous glands. The deeper tissues, such as cartilage, etc., are altogether unchanged (Hebra).

The course of the disease is generally extremely chronic, extending over months and years. The disease may remain stationary in any degree of development. Spontaneous recovery occurs even while soft connective-tissue tubercles are present, provided the cause be removed.

*Etiology.*—It is certain that a large proportion of acne rosacea cases is due to disturbances in the genital apparatus, and almost exclusively in the female sex. Pregnancy is likewise to be counted among the causes. Still acne rosacea appears also without such disturbances.

Chronic forms of dyspepsia, especially those with acidification, predispose to this disease. To the same cause must also be traced the connection between acne rosacea and the abuse of alcoholics, and it is for this reason that acne rosacea is more frequent in localities producing dry wines. Some even pretend to diagnosticate from the form of acne rosacea in tipplers the kind of liquor, and to beer-drinkers they ascribe a larger proportion of the cyanotic form of rhinophyma with small nodules and pustules; to wine-bibbers, the intense erythema with vascular dilatation and red papules; and to whiskey-drinkers finally, bluish or not at all discolored noses with oily seborrhœa.

According to Hebra, irritations directly affecting the skin, especially cold air and frequent change of temperature, likewise predispose to acne rosacea. With cold-water cures, too, the development of acne rosacea is frequently observed.

*Diagnosis.*—Great resemblance to acne rosacea is exhibited by the tubercular syphilide. The formation of ulcers, crusts, and cicatrices, the absence of the dilated blood-vessels, the simultaneous presence of other manifestations of syphilis sufficiently characterize the latter. From lupous and carcinomatous affections of the nose, acne rosacea is differentiated by its slow and benign course, never leading to ulceration or destruction of tissue.

The prognosis is favorable in so far as acne rosacea never leads to general disease; otherwise it is curable with difficulty and relapses are frequent.

*Treatment.*—The disease ceases with the cessation of the causes, as, for instance, in pregnancy, uterine effections, abuse of alcohol, dyspepsia, etc. Each of these diseases is to be treated according to its nature. In the graver degrees, or where no cause is demonstrable, symptomatic local treatment is indicated. This consists, in the main, in opening and evacuating the nodules and pustules and in maturing and curing those in process of formation. This is effected by the methodically repeated application of the irritants enumerated under acne vulgaris, especially the emplastrum cinereum, and in the case of tuberculo-pustular thickened noses, by cataplasms and painting once daily with a two per-cent alcoholic solution of pyrogallic acid. This treatment is continued until the skin is smooth and free from pustules. The task then remains of removing as far as possible the erythema and the vascular dilatation. Even the above-mentioned mode of applying the gray plaster in the shape of Unna's mercurial plaster-mull, with daily opening of the pustules by rubbing with a rough cloth, which at the same time always opens some blood-vessels, removes a great part of the redness. Whatever does not yield to the treatment with sulphur paste (see acne) which is then instituted and which is to be continued for weeks, is removed by mechanical means. The larger visible blood-vessels are laid open lengthwise, with a cataract needle or a lancet, and dressed with styptic cotton.

In the case of smaller blood-vessels and diffuse erythema, the entire reddened surface must be repeatedly scarified in several sittings, either in the shape of parallel scarification, numerous shallow incisions being made parallel to each other and across these, or else by the multiple punctiform scarification. A fine scalpel, the two-edged knife resembling a cataract lancet devised by Vidal, and the compound scarification of Balmanno Squire are suitable for linear scarification. Suitable for both methods, however, is the scarificator devised by my brother in 1873, which consists of six parallel lancets. To arrest the hemorrhage, the parts are covered with lint. Neither the slitting of the superficial vessels nor the scarification leaves any visible scars.

Unfortunately, however, a collateral circulation of dilated visible vessels is often established and calls for the repetition of the procedure. For the removal of isolated nodules Bruns' sharp spoon is excellent.

In the highest degrees of acne rosacea, in rhinophyma, nothing remains but plastic operative procedures.

## SYCOSIS.

*Definition.*—A chronic, non-contagious disease localized at those parts of the skin which are set with thick hairs, where it leads to the development of nodules and of smaller and larger pustules pierced centrally by a hair, as well as to smaller or larger, sometimes confluent perifollicular infiltrations and abscesses.

The beard with the hairy nasal mucosa form the most frequent seat of the disease; next the eyebrows and lashes, the pubic region, the axilla; the hairy scalp being most rarely affected. Men of from twenty to twenty-five years are most frequently attacked.

Associated with a feeling of some tension and heat, there are formed small red nodules, either isolated or more or less closely aggregated, the points of which are perforated by a hair and which change into small obtuse or pointed acne-like pustules. The latter either dry up, forming a small dry crust pierced by a hair, or they burst. By the confluence of the pus from several adjoining pustules connected purulent crusts are formed. When the efflorescences are closely packed, inflammatory infiltrations form also in the cutis surrounding the follicles and usually terminate in suppuration: hemi-

spherical, uneven protuberances of the skin often simulating the appearance of a furuncle or carbuncle. (These carbunculoid cuticular abscesses, emptying through many minute openings, arise from the confluence of closely adjoining pustules and abscesses.)

At the periphery of the affected parts new efflorescences arise, and thus the disease may gradually spread over the entire beard and the scalp.

When the hairs are pulled out at the beginning of the process, the root-sheath is found to adhere to the hair in the shape of a clear hyaloid cylinder. In later stages the appended root-sheath is opaque, and still later exhibits a purulent swelling. In the first case, the withdrawal of the hair is followed by a minute drop of blood; in the other two, a more or less turbid drop of pus. The farther the process has advanced the more loosely inserted are the hairs.

Should the sycosis not be treated, the above-mentioned cuticular inflammations and abscesses will form. Often the still retained hairs are surrounded with moist, verrucose, condylomatoid proliferations, bleeding on touch. Finally the loosened hairs are cast off and the cicatricial process commences, after which there remain flat or uneven, almost or quite hairless scars. The course is very chronic, sometimes lasting from ten to twenty years.

A still more chronic variety localized at the occiput has been named by Hebra: sycosis framboesiformis; in this form, firmly imbedded bunches of hair remain in the sclerosed scalp which is set with very hard tubercles and sometimes undermined by pus. Kaposi believes the disease to be an idiopathic process which has no connection with sycosis and calls it: dermatitis papillaris capillitii (*Archiv f. Dermat. u. Syph.*, 1869, p. 382).

The *diagnosis* is usually easy, but the disease may be confounded with eczema (which see), with the tubercular syphilide, with some forms of lupus, and with parasitical sycosis. The tubercular syphilide presents the sharp, painful margins, and the lardaceous fundus of the ulcer, peculiar to it. Lupus presents the primary lupus nodules and rarely confines itself to the hairy parts. The nodules of sycosis, when squeezed, often allow the pus to escape from a number of small openings—the mouths of the follicles. In parasitic sycosis (herpes tonsurans) microscopic examination will show the Trichophyton tonsurans. Parasitic sycosis occurs as red, hemispherical, perforated tubercles, up to half a walnut in size, which are isolated in the otherwise healthy skin of the beard. The hairs are lustreless and quite loose. The affection often extends to the beardless parts of the face.

The *etiology* of sycosis is quite obscure; in some cases the cause may lie in irritations affecting the skin directly, such as the profuse secretion of a chronic nasal catarrh. Eczema, when extending to the hair-follicles, leads to sycosis. Frequent shaving is not a cause, but one of the best curative measures of sycosis. Scrofulosis and syphilis have no connection with sycosis.

Hebra believes that perhaps the presence in the same follicle of two hairs may give rise to the disease; Lunger, that the development of a new small hair-follicle, the new small hair perforating into the old follicle, is the cause. Wertheim ascribes the irritation to the fact that the transverse diameter of the hair is relatively too large for its follicle.

*Prognosis.*—Sycosis is a curable disease; it never leads to disturbances of the general health. Relapses are not rare.

*Morbid Anatomy.*—Robinson (*New York Med. Journ.*, Aug. and Sept., 1877) found that the first inflammatory alterations always take place in the perifollicular regions, and

only subsequently invade the follicle. According to him, sycosis is primarily a perifolliculitis.

*Treatment.*—Internal remedies are ineffectual.

Very mild cases only can be cured without removing the beard, the pustules being opened with the knife, the nodules painted twice a day with an alcoholic solution of pyrogallic acid (1 : 50), and smeared during the night with the sulphur paste recommended for acne ; this should be covered with a wet compress and rubber cloth.

In graver cases it is necessary to remove the beard. It is cut as close as possible, any crusts present are detached with an emollient ointment (diachylon or a weak tannin ointment, 1 : 10 of unguent. lenient.), or with cataplasms. Then the hairs seated in mature pustules are pulled with tweezers and the skin is shaved. Then the affected spot is painted with the solution of pyrogallic acid 1 : 50 and by day the cataplasms, by night an emollient ointment or a non-irritating plaster are again applied. This treatment, combined with continued epilation of the hairs seated in mature pustules, is continued until pustules no longer form. Larger abscesses must be opened, larger tubercles scarified (punctiform scarification) so as to evacuate blood and pus, which method I greatly prefer to scraping with the sharp spoon.

The application of the sulphur paste is excellently adapted to prevent relapses. As a rule, I order it every night for three months, the beard to be shaved every morning. The shaving must be continued for at least one year. Should the skin become fissured from the application of the sulphur, I order a mild tannin ointment to be rubbed in after shaving.

If the above procedure fail, the entire affected spot must be epilated. With the tweezers hair by hair must be withdrawn in the direction of its growth, and the epilation of the after-growth, the other treatment remaining the same (only the shaving is omitted), continued daily until no more pustules are formed.

The verrucose, condylomatoid vegetations rapidly yield to a single painting with chloracetic acid.

Sycosis of other parts of the body is treated like that of the beard.

In sycosis of the eyelashes I have always had the best effects from epilation followed by painting of the affected spot with yellow precipitate ointment (1 : 50 of vaseline).

# MORBID CHANGES

## OF THE NAIL AND ITS BED.

BY

PROF. E. GEBER, M.D.

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THERE is great diversity in the situation, shape, size, etc., of the nails. These variations start almost without exception from the true point of formation of the nail. Therefore, in speaking of an extraordinary growth, etc., rather than of a material alteration of the nail, we must imagine it as a quite passive product, while the matrix generally is the immediate cause of it. The matrix, however, always requires the action of some etiological factor in order to depart from its physiological course.

Only in a relatively very small number of cases do changes of the nail occur; for instance, by the immigration of animal and vegetable parasites which arise in consequence of the influences from the matrix; but even there the matrix is nearly always secondarily implicated.

The nail, representing a plate of cemented epidermis cells, may exhibit an increase of its elements (hyperplasia) or a diminution of them (hypoplasia and aplasia), and a correspondingly hastened or retarded growth. It may possess also a deviation of form (deformity) or an altered color (discoloration), may have an unusual site (dislocation), and suffer an alteration of texture (degeneration).

### I.

*Excessive formation of nail substance* manifests itself either by a multiplication of the nails or by an augmentation of bulk.

This anomaly includes: the occurrence of nails on the last phalanx of supernumerary fingers or toes; the presence of double nails on one finger or toe; and finally the occurrence of completely or imperfectly developed nails at an unusual place, such as may be occasionally encountered after the loss of the terminal articulation on the first phalanx, on a metacarpal stump, etc., or else as a malformation in the region of the scapula (Tulpius).

*Onychauxis.*—Should the excessive deposit take place on the nail, the superabundance will be manifested either by the nail-cells being more closely aggregated and the

nail becoming more massive while retaining a nearly normal circumference, or else by an abnormal size of the nail, the elements not materially changing their mutual relation. Both kinds of alteration are designated onychauxis or hypertrophy.

These forms present essential differences. The nail in which the over-production manifests itself by unusual aggregation of the nail-cells appears unshapely, thick, opaque, glossy on the surface or spherically curved and of a grayish-white color, has a massive feel, is heavy and so hard that often it can be divided only with the scroll-saw. When the change affects the whole nail, it shows at its free border a tendency to curve downward.

The appearance is different when the deviations are based upon an enlargement of the dimensions, *i. e.*, the longitudinal or transverse-diameter or both.

Should the relation be disturbed in favor of the transverse diameter, this will manifest itself especially in the adjoining soft parts. Should the nail enlarge in its vertical diameter, it may reach a length of 12 cm., and this deviation is generally associated with alterations in direction; the nail being either turned upward by the mass of epidermis accumulated in the matrix, or curving in various ways (onychogryphosis). In its simplest form, the nail becomes claw-like, so that, if of sufficient length, it may reach as far as the interosseous space. Fig. 38 represents a gryphotic nail 7.5 cm. in length and 2.3 cm. in width. In other cases the nail curves spirally and may wind once or twice around its longitudinal axis (Fig. 39). Between these two kinds of deviation transitions occur.

Fig. 38.

Fig. 39.

Fig. 38.—Nail from a great toe. (Drawn from nature.)
Fig. 39.—Nail from the little toe of a woman aged 60. (Drawn from nature.)

Such nails as exhibit an altered configuration from accelerated growth are also changed otherwise. They are dirty yellow, slightly lustrous or yellowish-brown, yellowish grayish-white, have on their external surface strongly marked longitudinal ribs, at greater or lesser intervals transverse more or less elevated ridges, and here and there horny plates. The inferior surface is usually brownish in color, has an irregular, flaky exterior interrupted by smaller or larger cavities, and is crossed here and there by transverse ridge-like projections.

*Anatomy.*—On making longitudinal and transverse sections through gryphotic nails, we learn from the pretty uniform consistence at the surface that here only a slight deviation obtains; while toward the inferior surface there appears a harder or softer substance arranged in fan-like layers. At the more superficial layers the nail consists of small roundish or flattened round cells containing dark granules of various sizes. Along the

longitudinal axis, the cells are arranged more linearly, and more closely aggregated in places, especially those corresponding to the higher transverse ridges. Farther downward the cells are grouped in irregular masses, especially at the above-mentioned ridges. According to Virchow, they contain centrally horizontal masses of horn, which laterally, however, descend vertically, both together inclosing the "medullary spaces" first observed by him. On closer examination, they are seen to represent sharply demarcated cavities filled with a homogeneous, lustrous yellow or finely granular mass, and in them may be found, at times, epidermis cells in process of cornification.

When the gryphotic nail is lifted off, the bed looks shorter, is arched in the centre, and often narrowed. On removing the mass of epidermis usually largely accumulated at the surface, the greatly hypertrophied, longitudinally pointing ridges, and further backward the papillæ too, come into view. The latter exhibit large, dilated vascular loops with a slight small-celled infiltration around them. Moreover, this condition will be met with in no slighter degree all over the nail-bed and on a considerable part of the matrix.

Hence I conclude that both the anterior portion of the matrix and the entire circumference of the nail-bed are in a chronic state of irritation.

*Etiology.*—The causes of onychauxis may be congenital or acquired.

The former is the case in so far as the disposition dates from the embryonal period, and the anomaly appears in the course of life. A child born with macrodactylus comes into the world with a relatively larger nail, but the latter becomes very voluminous only by the part in question growing with disproportionate rapidity. More frequent and more pronounced in form is this onychauxis in children affected with the various cutaneous diseases associated with papillary hypertrophy (ichthyosis, cornu cutaneum, etc.).

In the great majority of cases the onychauxis is acquired, *i. e.*, traceable to direct causative factors. These may be idiopathic or symptomatic in nature.

1. *Trauma.*—Any considerable pressure acting for some time from in front or sideways on the phalangeal extremities (too short or narrow shoes), increases the nutrition of the nail-bed by the augmented afflux of blood, and provokes an over-production of nail substance.

2. *Defective or altogether neglected care of the nail.*—Nails present an excessive development wherever the care of the skin, and especially that of the nail, is grossly neglected. Voigtel narrates that he knew a man whose toe-nails, in consequence of uncleanliness, were much twisted, 6.5 cm. long and 6.6 mm. thick. The great accumulation of all sorts of substances on the nail-bed act as mechanical irritants, and lead to the hyperplasia.

Under this head belongs also the occurrence of excessive nail formation in old people and bed-ridden patients.

3. *The extension of morbid inflammatory processes* of the corium and the connective tissue of the cutis to the matrix of the nail (psoriasis vulgaris, chronic eczema, lichen exsudativus ruber, elephantiasis Græcorum and Arabum, etc.).

However, the diseases enumerated under this head are by no means to be looked upon as absolute causes of onychauxis. For every physician has certainly seen a large number of cases of chronic eczema, and still how rarely has he seen as a sequel hyperplastic malformation of the nails! Furthermore it should be emphasized that, in consequence of the last-mentioned cutaneous disease, we are not rarely liable to encounter conditions of the nails pointing, on the contrary, to a defective formation. Therefore we must admit that there must be, besides the immediate cause (cutaneous affection), some predisposi-

tion. In favor of this view is the fact that in isolated cases—*e. g.*, in eczema chron., psoriasis vulgaris—onychauxis arises even when the matrix of the nail is not implicated.

*Symptomatically*, hyperplasia of nail cells occasionally appears: 1. in neuropathic affections of a degenerative or irritative character, most frequently in spontaneous neuritis, neuralgia, chronic myelitis, traumatic lesions of mixed nerve trunks (glossy skin), and the like.

Furthermore, this alteration of the nails occurs: 2. after various chronic diseases, such as articular rheumatism, affections of the bones, ankylosis.

3. Partial hyperplasias appear after various ulcerative processes at the nail-bed, in which cases the remaining part of the matrix strives, as it were, to compensate for the loss.

*Symptoms, Course, and Termination.*—Nails altered in consequence of hyperplasia become noticeable in many ways. From a cosmetical point, they becom econspicuous by their deformities. A thickened nail has lost its elasticity, and hence will not only not contribute toward enhancing the tactile sense, but, by the continual pressure exerted by the stiff unyielding plate on its bed, this sense is diminished and often even reduced to a minimum. How is it with gryphotic nails? Here the finger tip is either entirely covered, or else, owing to the upturning of the nail, it is unprotected and thus, together with the exposed nail-bed, prone to injury.

If the finger nails are affected with the disease, even in the mildest form, the person is unable to execute fine work, and where the enlargement is at all considerable, is quite incapacitated for work. Fortunately, onychogryphosis is very rare on the fingers. Where the toe nails are affected, walking is interfered with, and in advanced cases, altogether impossible. One of the most frequent and at the same time most unpleasant effects (inflammations and suppurations) is produced by nails enlarged laterally; if left uncared for, they penetrate toward the lateral groove, *i. e.*, grow in. We shall return to this form more fully in connection with the treatment of hypertrophied nails.

The fully formed nail retains the acquired deformity unchanged, inasmuch as it undergoes no transformation of tissue. Therefore, we shall have the prospect of regeneration of the after-coming portion of the nail, and of its gradually regaining a normal appearance, only when it is possible to remove the morbific agent before the matrix is irrevocably degenerated. Hence normal nails will be likely to follow hyperplastic ones when the cause has been furnished by psoriasis vulgaris, chronic eczema, lichen ruber, etc. On the other hand, there is little or no hope that onychauxis will ever cease after elephantiasis Græcorum or Arabum, as the causative factors can never be completely removed. The same is true when the matrix has been altered by mechanical influences to such an extent that regression no longer occurs.

The prognosis, therefore, depends on the possibility of removing the cause of the hyperplasia of the nail.

*Treatment.*—The object to be attained consists in rendering harmless the morbid product, and then in its removal.

If the nail is troublesome on account of its abnormal longitudinal growth, then this encumbrance must first be removed, for which the scissors will suffice in simple elongation. Only when the thickness is increased at the same time, resort must often be had to the cutting pliers and even the saw.

If the nail has enlarged in width, it will press on the lateral furrow to a variable extent, and when this is coupled with compression from the shoe, there will appear at first

great irritability of the soft parts; and later, inflammation, suppuration, great proliferation of granulations, destruction of the cutis, of the tendons, of the muscles, and even opening of the phalangeal joint, caries and necrosis of the bones—paronychia lateralis. Usually the internal angle of the great toe is implicated in this process, rarely the outside of the little toe, and hardly ever any other toe. Sometimes even children of from one to two years show symptoms of this affection.

The hyperplastic broad nail does not alone give rise to paronychia lateralis; the infolding of the edge of the skin by the shoe, laceration of the fold, traumatic lesions, and various ulcerative processes may likewise cause an affection which cannot be differentiated from that described, either in its course or termination.

On close inspection of a paronychia lateralis in its initial stage, we note the reddening, tumefaction, and heat of the skin. At the same time the patient experiences pain at the slightest touch. If the causative factor be removed, the inflammation soon subsides, and at most a disagreeable sensation is felt for a few days. When immediate relief is not obtained and the process extends, suppuration takes place, and there is formed either a true abcess, or a diffuse suppurating wound surface, offensive from the admixture of the decomposed secretion around it. In either case the inflammation may extend into the depth, and possibly destroy the subcutaneous connective tissue, muscles, tendinous sheaths, periosteum, and bone. In exceptional instances, with long-continued suppuration, there may be loss of the affected phalanx, and even of the foot in the case of cachectic dyscrasic persons.

Usually, however, the course is less violent. The process assumes a chronic, now and then exacerbating character, and may lead to extensively undermined, but rather superficial destructions by the burrowing of pus. Such a suppurating surface always looks very irritated, is uneven at its base, and covered laterally by irregular spongy, easily bleeding granulations. With lateral pressure on such an inflamed phalanx, pus comes to the surface from various points. Such a paronychia may last for years.

In the beginning of the affection it is generally sufficient to remove that part of the nail which threatens to grow in, besides putting into the groove fine threads of charpie, and ordering wide shoes to be worn in the future.

However, if the inflammation is intense, or if even suppuration and proliferation of the edge of the nail are present, it is advisable to employ the method of complicated lateral pressure. The portion of the nail projecting into the inflamed part having been removed, the swollen edge of the skin is carefully pressed downward, and the widened space thus gained at the furrow is filled with accurately inserted threads of charpie or cotton. In doing so, regard should be had that a part of the filling comes to rest under the sharp edge of the nail, in other words, that the latter do not come into direct contact with the irritated part of the skin. This done, stripes of adhesive plaster are wound around the ungual phalanx in such a way as to commence at the affected part from above downward, each turn being moderately stretched, so as to remove the border of the skin as much as possible from the edge of the nail, that is, to crowd it downward. This procedure, if performed with some skill, causes absolutely no pain to the patient, but eases his condition at once to such an extent that he can not only walk but even wear shoes. After twelve or twenty-four hours, the dressing is taken off, the foot bathed for a short time, and bandaged anew. If the patient has perseverance enough to continue this treatment scrupulously for several weeks, he has good prospects of being entirely freed from his trouble. Various authors add to the charpie some medicinal solution, caustic potash, camphor jelly, carbolic solutions, etc., and instead of the diachylon plaster use

emplastrum hydrargyri, aconiti, lithargyri fusci, etc. If greatly developed fungous granulations are present, they are cut away with scissors down to their base, and the bleeding points touched with silver nitrate or caustic.

In very exceptional cases, nothing remains but to resort to the radical operation of Dupuytren. For this, the pointed end of a pair of scissors in inserted under the nail as far as the limit of the affection; then the nail is divided into two parts, and, by firmly seizing at the anterior margin the one belonging to the diseased side with pliers, and drawing it vigorously forward with a twisting motion, the affected furrow is freed from its irritant. Then the wound surface is bandaged and treated according to surgical laws. Inasmuch as this operative procedure is always very painful, the patient must be anæsthetized.

We must next endeavor to overcome the fundamental affection, and must therefore trace the etiological factors, which will not be difficult if the ungual phalanx is carefully inspected.

If an eczema exists which has extended to the ungual phalanx, this, too, will have to be treated on dermatological principles. In the first place, we must remove the cause of the eczema, and then treat it, if it be of the moist variety, with diachylon ointment, naphthol, salicylic acid, etc. In stubborn cases, I should strongly recommend vulcanized rubber stockings, gloves, etc., according to the seat of the disease. When eczema is present on the body, but not on the affected phalanx, an anti-eczematous local treatment will be of little use. We may then exhibit iron, which is well known to be very useful in eczema of the anæmic, chlorotic, dysmenorrhœic, etc.

In psoriasis vulgaris of the ungual phalanx, we must first of all overcome this affection by the usual remedies—tar, carbolic acid, chrysarobin, etc. Should the hyperplasia of the nail appear only symptomatically (in consequence of psoriasis), we must strive to master it by the use of arsenic.

In the case of the sequels of elephantiasis Græcorum, the hope of improving the after-growth of the nail is very slight. All our assistance will consist in keeping the affected part clean and removing injurious influences.

It will be almost the same with all those diseases associated with connective tissue and papillary hypertrophy at the terminal phalanges—pachydermia, ichthyosis, verruga, etc.—where, in the most favorable case, we shall be able to effect a temporary arrest of the exacerbation.

On the other hand, when the disease of the matrix and nail-bed is due to any form of syphilis, a great deal can be accomplished. During the papular stage, when weeping is present, it is well to apply chlorine water or solution of common salt followed by dusting with powdered calomel. If a change in the dressings is desired, we may employ solution of corrosive sublimate (0.1 : aqua destillata 25). The weeping having been relieved, strips of emplastrum hydrargyri should be wound around the affected part. This plaster, however, will act rapidly and surely also in syphilitic gumma, periostitis, and ostitis. Should spots of syphilitic degeneration on the phalanges give rise to the excessive nail formation, local sublimate baths (1 gm. for each bath) are to be particularly recommended. Besides this, gray plaster or, to make the ulcerated part more accessible, powdered iodoform.

Should it be some traumatic influence which causes the morbid change, we must ascertain its nature. If the shoe is at fault, we must see to it that it is neither too narrow nor too wide; it should be fitted to the form of the foot and allowance made for any special sensibility of the foot (Camper, la Forest). Where oft-repeated lacerations

at the furrow maintain the irritative conditions, they should be guarded against by frequent removal of the stiff cones of epidermis. Should the occupation possibly contribute to it (baker, carpenter, etc.), it is advisable to surround the end of the phalanx with soft wax.

## II.

*Defective formation of the nail*, atrophy of the nail, hypoplasia and aplasia of the nails. The absence of the nails (anonychia) or their retarded growth may be congenital or acquired.

On insufficiently developed fingers and toes we not rarely encounter, together with complete absence or defective development, mutilation and coalescence of the nails.

More frequently these conditions are acquired, and may affect the entire nail or only a part of it. They may appear, moreover, as the expression of a local or general disturbance.

*Etiology.*—As local causes we enumerate :

1. Trauma, which, under similar circumstances, produces sometimes hyperplasia, sometimes aplasia. Should the shoe press upon the bed of the furrow so as to narrow it, the nail-bed is lifted up like a wall and thus hindered in its activity. The result will be that only a thin plate is produced. Should there be at the same time a strong pressure backward from in front, a part of the matrix is placed out of function and even complete arrest of the nail-formation may ensue. The nail-formation at the affected part may also be hindered by a knock, blow, pinching, etc. I look upon the white spots, on the nails of children, artisans, and hard-working day laborers, as an insufficient cornification of the nail-cells traceable to mechanical influences.

2. *Thermic and chemical irritations.* High degrees of cold may cause even complete arrest of nail-formation. In the same way, a glance at the frayed-out, crippled nails in workmen forced to handle strong acids teaches us to what an extent the latter may damage the development of the nails.

3. *Inflammations associated with suppuration and ulcerative processes.* In suppuration of a part of the nail-bed, while it continues, the matrix being otherwise employed, there will be an arrest, and with degeneration of the tissue (panaritium), a permanent cessation of production. Hence we find, spread over a greater or lesser portion according to the extent of the process, either a narrowed nail, or one showing a circular or oblong loss of substance as if punched out, or complete absence of the nail. Adjoining this defective formation, pronounced hyperplasia is usually present. Henle has called attention to a peculiar atrophy of the nail in consequence of suppuration of the nail-bed and obliteration of the furrow.

Among the causes of retarded nail growth we mention the following constitutiona disturbances :

1. *Every febrile condition.* In fever the increased heat is produced at the expense of the augmented transformation of tissue and hence the consumption is greater than the reproduction. But as this disturbance extends over all organs and tissues, the result is that, during the continuance of the fever, the elaboration of nail-substance is diminished or entirely suspended. A patient with a grave form of typhoid fever will certainly not be able to form nail substance, and this holds true of pneumonia, peritonitis, pericarditis, etc. When the febrile condition is associated with an exanthem or a cutaneous affection, the extension of the disease to the nail-bed will also play a part.

In temporary fever the defective formation of the nail can only be demonstrated by

comparative measurements or by weighing of the clipped portions. But if the febrile state continues for some time, the defect may increase from a delicate streak running across the nail to a commencing furrow, partial shedding, total arrest, and finally loss of the nail.

2. *All chronic wasting diseases of the entire organism* will also cause defective nail-formation. The new-growth of the nail becomes insufficient in all disturbances which are followed by defective elaboration of blood, and in diseases associated with pronounced cachexia. Such a nail is usually like an embryonal duck-bill, thin, discolored, lustreless, soft and curling at the end, or brittle, crumbling.

Under this head should be enumerated the distorted nails of chronic tuberculosis, which grow long on account of not being trimmed and acquire this appearance from the morbid development and the atrophy of tissue at the tip of the finger.

3. Those cutaneous diseases and nervous affections which produce hyperplasia of the nails, may give rise under certain conditions to more or less aplasia and complete loss (Joffroy in ataxia, and Pechelin in ichthyosis).

*Symptoms, Course, and Termination.*—In general we take a nail to be imperfectly developed when it is whitish gray, lustreless, thin, delicate, giving the impression of a thickened membrane; possessing but slight hardness, readily broken, and flexible. At times the substance is so friable that it exfoliates longitudinally and fractures through its thickness, thereby rendering the nail uneven.

If we wish correct information about the several phases of this abnormality, we may inspect the nails during some prolonged febrile condition. Even in the beginning the nails are not affected in an equal degree. Some of them are apparently still quite normal and present merely a diminished lustre. Others show a narrow lustreless strip running across—defective cornification—which on other nails changes to a broad furrow and, eventually, to a pronounced groove bounded in front and behind as with a wall by the termination of the process. Almost without exception the nails of such persons present transitions passing into complete cessation of nail formation. In the middle of the above-described groove we see a lack of substance, often limited by irregular borders, but which affects only the uppermost layers. If of higher degree, the loss of substance extends to the lateral parts of the furrow and through the entire thickness of the nail so that the latter is attached to the bed only by its body. Finally we meet with defects so complete that between the old and the new rather unshapely nail there is an arrest in the formation of substance, the former being easily pushed off as a foreign body.

In cases of ulceration it may happen that the destruction of the matrix is more or less total. Under these circumstances, either only a small degenerated stump or no nail substance at all is formed; the whole nail-bed remaining covered with a dry and resistant mass of horn, and changing into the ordinary cutis.

*Treatment.*—The first task we have to fulfil must be to render the subsequent condition tolerable to the patient. Therefore, when the nail interferes with the avocation or is otherwise troublesome, we should advise frequent trimming, and covering with a protecting layer (wax) to guard against injury.

In the next place, we shall have to look after the removal of the etiological factors causing the defective nail. The main point is to keep aloof any possible injurious influences, together with traumatic, thermic, and chemical effects; to cure by appropriate means, skin diseases, dyscrasic conditions, nervous affections, inflammations, and ulcerative processes; and, where impaired nutrition or defective elaboration of blood is at fault, to support the constitution of the patient.

Where the defective nail formation is the consequence of incurable diseases, its importance can only be looked upon as subordinate. When the diminished growth occurs in grave febrile conditions, it will cease with the return of health and strength.

In order to hasten the after-growth of the nail, it will be advisable to exert an equable pressure by strips of adhesive plaster on the wax nail fastened to the nail-bed.

## III.

We will now discuss a series of other dystrophies, whose type manifests itself either by a deviation of form (deformity), a degeneration, or a discoloration.

1. *Deformitas Unguium.*—Malformation of the plate of the nail is a sequel of disturbed function of the matrix. The following must be enumerated as causes :

*a.* Primary disturbances of nutrition and defective innervation of the matrix (in cases of paralysis).

*b.* Secondary interference with the function of the matrix from trauma and malformations of the lateral furrow, inflammations of the underlying connective tissue, periosteum, bone, etc.

Nails suffering an alteration of form may be abnormally long or short, broad or narrow; usually, the nails are flat or curved. Where the latter condition obtains, the process may be lateral, whereby the nails look like long points; or it may affect the surface, when sometimes convexity (in malformation of the heart), sometimes concavity is more prevalent. I remember a case in which the nail of the right index finger was bent to the right on the forward projecting root part, and toward the left in its body. This distortion is said to have formed after a cut from a sharp knife received in childhood. Bleeh relates a case of deformity of the nail, which is said to have been hereditary, the mother, several sisters and brothers also suffering from it.

To what extent such nails interfere with the avocation cannot be laid down as a rule. Often they merely appear ungraceful; in another case, however, especially when greatly incurvated, they may form a veritable plague for the person affected with them.

In most cases they continue through life, as they are not amenable to treatment.

2. *Degeneratio Unguium.*—As a result of improper nutrition, but chiefly in consequence of chronic inflammatory processes (paronychia sicca) of the matrix, we sometimes observe a morbidly altered nail substance which strikes the eye either by a thick or thin appearance, but more frequently by a fibrous quality, a spreading apart of the mass, and an irregular detachment of particles. Usually such nails deviate also in color, all sorts of transitions from grayish white to a dirty yellowish gray being encountered.

Aside from the disfigurement, these nails are very troublesome, as they break from very slight causes, thus maintaining a partial denudation or a continuous irritability of the nail-bed.

In order to treat the faulty nail-formation effectually, we must always endeavor to remove the cause. Locally it will be well to apply the pressure bandage (wax nail) recommended for defective nail formation.

Fig. 40.

3. *Discoloratio Unguium.*—A number of medical writers have ascribed to the appearance and especially the color of the nails an exceptional importance which does not belong to it. In cases of cyanosis and during attacks of intermittent fever the nails are

said to become livid; in convalescence from febrile conditions, white; in paralysis of both upper extremities, chalky white; in anasarca, light white; in icterus, yellow; in consequence of apoplexy, dark-brown; in hectic conditions, pale; and with certain diseases of internal organs, gray. However, if we devote sufficient attention to all these descriptions, we become convinced that all the alleged discolorations rest partly on well-known processes of nail formation, partly on misconstruction or disregard of the physiological relations, *i. e.*, on translucency of the nail substance and the appearance of the nail-bed.

IV.

In the introduction to the alterations in question it had been stated that a change of texture of the nail may take place also beyond the point of production. In entering on the discussion of this possibility, we must ask, in the first place, what is the nature of the factors producing these anomalies? In my opinion, excepting isolated occurrences enumerated with the various anomalous formations, only influences from without affect the fully formed nail. Among these are:

1. *Traumatic and chemical injuries.* These include the use of tools, or of alkalies or dilute acids in various trades (joiners, hatters, etc.).

2. *Animal and Vegetable Parasites. a.* Sarcoptes scabiei may give rise to the most manifold changes in the texture of the nail, and, secondarily, anomalies of shape and growth. Boeck states that in the degenerated nail substance the eggs and excrement of the Sarcoptes were to be found. R. Bergh demonstrated that the deviations of the nail due to Sarcoptes are brought about on the one hand by affection of the nail-bed and matrix, on the other by implication of the substance. The collective result of this influence is, that the nail-bed thereby becomes hypertrophic and greatly bulged out longitudinally in the middle. Corresponding to the degree of this deviation of form, the lower surface of the nail is studded all over with irregular projections and hollows, often even deeply excavated or conically depressed. The nails sometimes have the form of a high, rounded, pyramidal horn, sometimes that of a laterally compressed claw, and between these various intermediate forms occur. On their surface they are irregularly curved, and of variable (up to 16 mm.) thickness and breadth. Their color on the average is dull yellowish white, whitish yellow, and darker in the furrows. They are rather hard, but still can be readily cut. Sections through the substance of the nail show even to the naked eye the asbestos-like whitish, here and there grayish yellow, flaky or fibrous appearance of the axial portion; the pumice-like whitish aspect of the surface; and the more yellow appearance of the cortical mass. On microscopic examination Bergh found in the substance of the nail itch mites, eggs, egg-shells, burrows, skins, and excrement of the parasites.

There are also a number of flies in tropical regions which lay their eggs under the nails. None of these insects, however, is as much feared as the sand-flea (Pulex penetrans), which causes first violent pain and subsequent paronychia associated with loss of the nail.

*b. Vegetable Parasites. Onychomycosis.* When either in the neighborhood of the ungual phalanx or on some other part of the body accessible to the finger, there is a mycosis of the skin, the nail is more easily implicated on account of the continual opportunity for auto-infection. Hence we meet with onychomycoses in disproportionately greater frequency as secondary than as primary affections. And in cases in which no mycosis of the skin can be directly demonstrated, we cannot conclude positively that it has not been present.

In only two mycoses of the skin—favus and herpes tonsurans—has it been clearly demonstrated that transference of their fungi can cause changes of the nail, *i. e.*, onychomycoses.

Of the two causes of onychomycosis, tinea favosa is rarer than trichophyton tonsurans; and on the toe-nails the former is exceedingly rare. The clinical picture of the affection is rather similar in the majority of cases, the taking root of the fungi being particularly conspicuous in the beginning. Such nails are brittle, frayed-out, intersected by furrows; they present a discolored, opaque, grayish yellowish white appearance, and are lifted up according to the quantity of the epidermis accumulated under them. When the process continues for some time, the alteration extends to the entire nail, and the matrix being implicated, changes of growth are also present. The nail becomes gryphotic, thickened, flakes off even on the surface, and being detached here and there and acquiring a faded, dirty yellow color, it often becomes greatly disfiguring. In isolated cases due to favus, the nail shows the sulphur yellow, circumscribed, scutcheon-like depressions peculiar to that disease; but they should by no means be mistaken for the discolorations resembling them which are perceptible at the margin of punctate points of degeneration occurring after grave febrile diseases (small-pox) and which must always be interpreted as a morbid formation starting immediately from the matrix.

Altogether, in forming the diagnosis of onychomycosis we must proceed with great caution, for we must bear in mind that lack of care of the nail, as well as the sequels of chronic eczema, psoriasis, etc., may present exactly similar clinical pictures. When fungi are found, the fact is beyond dispute; if not, we are not justified in positively concluding that the disease is absent.

Longitudinal and transverse sections through a nail changed by the proliferation of fungi show it to represent an either totally or partially loosened, flaky, disintegrating substance to which adheres a dull white or gray yellowish white mass. When the latter is spread apart and clarified by means of glycerin, it is possible to discover under the microscope convoluted threads of mycelium and conidia mixed with varying quantities of cornified epithelial cells. Fine sections of the nail, when carried through the entire thickness and placed in caustic potash solution (1 : 50) show a more concentric arrangement of the fungous parts, whence the threads of mycelium extend between the nail-cells and around them in all directions.

G. Meissner, who discovered the fungi on the nail, leaves the question as to their origin entirely out of consideration; while Virchow arrives at the conclusion that more than one form of fungi occurs in onychomycosis, that even several forms may be present in one and the same nail. Although the latter part of this proposition could not be maintained, subsequent investigations have unquestionably established the fact that both Achorion Schönleinii and Trichophyton tonsurans are capable of producing the above-described alterations of the nail.

*Treatment.*—Owing to the extreme intractability of the affection, the treatment must be carried out with great perseverance. It is advisable to trim the nail close as often as possible and to paint it thoroughly several times daily with a solution of corrosive sublimate (0.5 per cent), benzin, petroleum, etc.

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As an appendix, we shall discuss the paronychiæ—acute inflammations of the tissues underlying the nail.

1. *Paronychia traumatica.*—Puncture, concussion, contusion, laceration, penetra-

tion of foreign bodies, etc., may give rise to inflammations, with various results, either on the middle (P. centralis) or at the sides (P. lateralis) of the subungual tissues. The lesions are often overlooked and in general are not proportioned to the succeeding inflammation. Toward the third or fourth day, the patient will feel some slight disagreeable sensation in the terminal phalanx which increases especially on pressure. Soon, however, a more circumscribed spot becomes reddened, swollen, warmer, and especially painful to the touch. If recovery does not occur at this stage, the inflammatory process will vary according to its site. If superficial, small abscesses form which often evacuate their contents spontaneously and heal completely within a few days. If the inflammation has taken root more deeply, swelling and rise of temperature occur over the whole ungual phalanx; violent pains are present which radiate upward toward the arm. When suppuration has commenced, the symptoms become more violent. In lateral paronychia we observe a projection at the edge of the nail over which the latter is elevated, and the surrounding soft parts, infiltrated with serous fluid, are crowded aside. This form of inflammation offers at least the advantage that the fluctuation is soon recognized, and the patient thus easily relieved. However, when the suppuration is situated farther back or toward the centre, the pulsating pains become almost unbearable. In such a case a considerable amount of the surrounding tissue is inflamed, partly suffused and livid, the epidermis raised in form of a blister, and the root of the nail opaque and projecting in a rounded shape.

The termination of all these inflammatory processes, which often exhibit a phlegmonous character, is always in recovery. Sometimes it terminates in destruction of the nail, of the subcutaneous connective tissue, of the muscles, tendinous sheaths, etc.

*Treatment.*—The limb must be kept at rest, and when the inflammation affects the fingers, carried in a sling. Cold compresses should be used to moderate the swelling and pain. When suppuration has set in, we should first apply moist heat to hasten the process, and then open the abscess cavity. If pus is not visible under the nail, the latter should be scraped until translucent so as to confirm the diagnosis. If the presence of pus is established, we can penetrate by means of bistouries either from the surface or from in front, in order to give free exit to the pus, and eventually remove any foreign body possibly present there. The subsequent treatment is based on well-known surgical principles.

2. As a consequence of impaired vitality and in patients affected with grave chronic diseases, we occasionally observe a malignant affection of a part or of the whole of the tissue underlying the nail which Wardrop terms onychia maligna. Without any demonstrable cause the individual feels violent pain in the ungual phalanx. With steady increase of the pains, the phalanx begins to swell at some point where heightened temperature is observable. When we attempt to stir the nail at its free anterior edge, we are surprised to see how soon the root is detached from the bed. When the root is lifted by depressing the edge, it is seen to lie in a cavity filled with discolored pus, and its posterior edge appears thinned, dirty gray to brown. When we insinuate the points of the scissors from behind forward under the nail, we can often penetrate in the more advanced cases without any difficulty as far as the anterior end of the nail-bed, and ascertain that the nail is attached only at one or more lateral portions. On inspection of the surrounding portions of the skin, we are struck at once by the great swelling encompassing the root of the nail on which the epidermis is raised as by a blister or perhaps detached, and the cutis of which shows some losses of substance which bleed readily. When exerting but slight pressure upon it, the patient experiences great pain, and from the bottom of the furrow

some offensive sero-purulent fluid mixed with blood is evacuated. When the above-described swelling is crowded backward, we perceive a very dark to bluish red spongy mass which is broken down, friable, and interspersed with small spots of degeneration. This ulcerative process extends sometimes only to the central part, but sometimes over the entire nail-bed. As a rule the patient becomes still more depressed during the continuance of the affection; anorexia, and sometimes even febrile movement are present. The process is very protracted, often lasting many months.

*Etiology.*—Thus far it has not been possible to ascertain any definite causative factor. As regards the slow course, Rayer expressed the conviction that the nail plates ever newly forming in the spongy tissue maintain the process; against this view Bizzioli has recently emphasized that it is rather the numerous rough places on the under surface of the nail which maintain the suppuration and degeneration. Cases under my observation gave me the impression as if scrofulosis, cachexia, oligæmia, etc., furnished the first instigation for the disease, and as if there were present a process anatomically related to moist gangrene (Billroth).

*Treatment.*—The conditions to be fulfilled are twofold. By the most scrupulous cleanliness we must guard against the accumulation of pyogenic or the occurrence of septic matters; the dressing—Burow's solution, Lister, thymol, etc.—must be applied in such a manner that cavities and pockets cannot easily form; the luxuriating surfaces are touched with fused silver nitrate or sprinkled with nitrate of lead powder, and in order to learn the condition of the wound, surrounding strips of lead plaster are renewed every third or fourth day. Besides, we must give a strengthening diet, and endeavor to combat the fundamental affection.

# ANOMALIES

OF THE

# SUDORIPAROUS GLANDS AND THEIR FUNCTION.

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THE sweat glands have an independent ample vascular system surrounding them, and specific nerve-fibres influencing their activity. Each epithelial cell of the convolutions represents an elementary secreting organ. On account of their difficult accessibility, our knowledge of the pathological processes of the sweat glands is in many respects defective. Still there is no doubt that they are exposed to hyperæmia, inflammation with its various terminations, hyperplasia and hypoplasia, hypertrophy and atrophy, the manifold neoplastic processes, to the same extent as the larger glandular formations. We shall first deal with the diseases of the sweat glands in the most restricted sense, and then with their abnormal activity.

## I. INFLAMMATION OF THE SWEAT GLANDS.

Inflammation of the sweat glands is one of their most frequent diseases. As in other glands, it occurs in an acute, subacute, or chronic form, and, when the inflammatory process has not advanced too far, it may resolve, or else change into suppuration, abscess formation, hypertrophy, atrophy, fatty, hyaline, and other degeneration.

*Etiology.*—Inflammation of the sweat glands may appear primarily, idiopathically, or secondarily by extension from the neighborhood, or as a sequel of other general diseases. The former is possible when the pore is occluded, or when mechanical irritations, as by eczema, prurigo, scabies, pediculosis, etc., continually affect the skin. The latter may be the case when the last-described and other similar factors produce inflammation of the skin, and the inflammation extends by contiguity from the surrounding connective tissue to the gland (*periadenitis sudoripara*); when the affection arises after grave

febrile diseases—typhus, polyarthritis acuta, cholera, pneumonia—and in the train of marasmic conditions—cachexia, scrofula.

*Anatomy.*—In the simplest form the cells are traversed by a fine dust-like protoplasm, and appear slightly distended. The canal becomes narrow in proportion, and the gland, as a whole, seems enlarged. When the process has gone further, the cells lose their normal outline, the contents become opaque, the nuclei divide, and the nuclear corpuscles are increased. In the adjoining connective tissue a large number of leucocytes are noticed, chiefly around the vessels. Later, the greatly altered cells enter the canal of the gland, where they disintegrate and are pushed forward and displaced by the continually following pus-corpuscles. The final result of an exudative inflammation is either complete disappearance of all trace of a sweat gland (abscess of sudoriparous gland), or else we find in the loosened, wide-meshed connective tissue corresponding to the region of the pars reticularis cutis, partial outlines, whose centrally directed lumen and possibly still remaining epithelioid cells permit their interpretation as the remnants of glands.

*Symptoms, Course, and Termination.*—We shall take for our starting-point one of the relatively most frequent localizations which presents a more pronounced clinical picture. I refer to those inflammations of the sweat glands which are not unfrequently met with at a distance of one and a half to three centimetres from the anus.

The first symptoms are usually insignificant. Some occasionally recurring itching is present to which but little importance is attached. By-and-by, however, it becomes more frequent and changes to a burning, and the skin feels rather warm. As the inflammation increases, more violent pains and heaviness are experienced, and on careful examination a nodule may be demonstrated in the depth. In this stage, it is possible to cause dissipation of the tumor and resolution of all the inflammatory symptoms, by the avoidance of every movement and the employment of ice applications. If this improvement is not soon brought about, the skin will become much reddened, infiltrated, painful, and hot; in the centre of the patch may be felt a perpendicular hard cord, starting from a broader base—the enlarged nodule—toward the surface where it terminates either in a roundish or flattened elevation. At this time suppuration is usually present, though it is not easily demonstrable because so deeply seated; when we, however, insert a bistoury as deep as possible into the tissue, there is evacuated some thin fluid, occasionally more viscid pus mixed with crumbly particles. If the evacuation has been early enough and the patient takes care of himself, a few days' treatment often suffices to arrest the suppuration. In the opposite event, the suppuration extends far, and deep suppurating wounds may arise with sinuous tracks and perforation of the rectum (fistula ani). In marasmic individuals the course is particularly slow. The melting down of the surrounding tissue then appears in the form of cold abscess, and fistulous tracks are relatively frequent. Sooner or later, cicatrization takes place, the characteristic of which is that the surface is drawn in. The deep infiltration usually persists the longest, and with rare exceptions gives rise to frequent relapses.

Inflammations and abscesses of the sweat glands are also met with more frequently on the labia majora, in the axilla, and on the scrotum.

*Differential Diagnosis.*—It will not always be easy to distinguish inflammation and abscess of the sudoriparous glands from circumscribed phlegmons, furuncle, syphilitic gumma, etc. But the former affection begins as a deep movable nodule; is never associated with fever; is especially painful on pressure; permits the recognition of a firm cord extending upward; on the surface, according to the state of the overlying cutis, it

appears sometimes as a roundish projection when the cutis is loosely joined to the subcutaneous tissue, sometimes flattened when those structures are firmly connected; it commences to suppurate at the base; the suppuration often ceases remarkably soon after being punctured; it leaves a retracted cicatrix and a deeply imbedded infiltration which, by reason of its slow absorption, often gives rise to repeated relapses.

*Treatment.*—The treatment depends on general surgical principles. The main thing is to remove every injurious influence, and to provide absolute rest of the part in question. As long as the inflammation is not yet circumscribed, we may restrict ourselves to cold or ice applications. When the nodule becomes distinctly perceptible and the pains are continuous and serious, puncture should not be delayed, even if fluctuation cannot be demonstrated; when an abscess has formed, nothing remains but to expose the wound by a free incision, and to cause it to heal by appropriate dressings and attention. Even then relapses will be relatively frequent.

## II. HYPERTROPHY AND ATROPHY OF THE SWEAT GLANDS.

A. *Hypertrophy.*—Enlargement of the sweat glands is sometimes congenital, in the case of general excessive development of the body, or gigantic growth. More usually, however, it is acquired and forms either autochthonously or is produced secondarily.

*Etiology.*—The simplest form of the former mode of development is represented by those idiopathic hyperplasias occurring in connection with those of the epithelium and the papillary body of the cutis. Under the same head belong also the soft warts (acrothymion) mentioned by Bärensprung, in the substance of which, as well as beneath, we may often find heaps of sweat glands enlarged up to one millimetre. The same condition may frequently be demonstrated in ichthyosis. These occurrences, however, are merely of an anatomical interest; while the hypertrophies, whose elements extend far beyond the normal measure, are in every way of greater moment and deserving of a more detailed consideration. Without any demonstrable cause there occurs, in the cases belonging under this head, a proliferation of the glandular epithelium which shows no other change than possibly enlargement, so that the wall at first is made to bulge out and later to project in the shape of a finger-like prominence. If we imagine the process continuing, every single spur again throwing off others, etc., we obtain a number of smaller and larger tubuli, like a dendritic anastomosis. As long as the gland is capable of performing its secretory activity, we can only look upon it as simply hypertrophic. But whenever it begins an independent existence no longer adapted to its previous function, it acquires the importance either of an adenoma when its outgrowths retain the glandular character, or that of a destructive neoplasm when epithelium and stroma proliferate in favor of the former.

Besides the genuine hypertrophy of the sweat glands, we must enumerate the following causes for their development: 1. Increased activity. In a number of grave diseases, it is certain that the profuse perspiration is attended by enlargement of the glands, as in cachexia, scrofula, articular rheumatism, phthisis, etc. 2. Mechanical, chemical, thermic, and electrical irritations. All of these factors, if continued for some time, cause a greater supply of nutrition either exclusively in the glands or in the cutis with its adnexa, and thereby increased formation of elements. 3. Inflammatory processes. Acute inflammations of the cutis, when the sweat glands participate, provoke only a temporary increase of the cells. On the other hand, after chronic inflammations they are almost always altered, most frequently enlarged. In skin thickened by elephantiasis, the excretory duct

of the gland is lengthened, the secretory or convoluted duct enlarged, the lumen dilated and the wall broadened in consequence of augmentation of the epithelial layers and increase of volume of the elements. Similar results appear wherever like conditions prevail, as in prurigo, eczema chron., sclerema adultorum, etc. 4. Proliferative processes of pronounced cellular character, *e. g.*, lupus vulgaris, lepra tuberosa, carcinoma, sarcoma, etc. The process here is the following: Either the specific proliferation of the neoplasm excites the elements of the sweat gland to homœoplastic production, or else it penetrates the membrana propria, infects the glandular contents, and its peculiar cells becoming ever more numerous in the gland, a heteroplastic proliferation is finally established. In the former case there result, in the beginning, purely hypertrophic sweat glands with extensive formation of spurs. As a rule, however, this does not continue. Gradually the lupus and other cells continue to advance and cause the glandular cells to perish, so that lupus, for instance, spreads at the expense of the sweat glands and fully replaces the latter unless the specific proliferation is arrested before. If infection of the glanular epithelia has taken place early, hypertrophic parts of the sweat glands may still occur, but they soon succumb to their fate. Accordingly we finally find long-drawn cones and anastomoses formed of heteroplastic elements, which could only lead us to suspect their origin unless perhaps remnants of the gland substance have remained on the terminal portions.

*Symptoms, Course, and Termination.*—If the activity of the sweat glands were to keep equal pace with its enlargement, and the quantity of the product secreted were exclusively dependent upon it, hypertrophy and hyperhidrosis would be equivalent. However, this is by no means the case, because the secretion is directly subordinated to nervous influence. Thus hypertrophic sweat glands may exist for a long time without becoming clinically at all perceptible. Enlargement of the gland will coincide with increased secretion only when both are based on the same etiological factor (phthisis), or when the conditions are given for both independently of each other. In the contrary case, enlarged sweat glands may even be associated with diminished perspiration. This is true also when isolated parts of glands are hypertrophic while the gland is affected with infiltration or heteroplasia.

The course and termination of hypertrophy of the sweat glands are manifold. It may persist for years without essential alteration; but it may also change into unlimited growth and, in that case, either maintain its typical character (adenoma), or undergo a thorough transformation (carcinoma). It may happen with equal frequency that, in consequence of the exhaustion, atrophy occurs; or by occlusion of the duct or opening, cyst-formation; or, by regressive metamorphosis of the glandular elements, fatty, hyaline, colloid, and other degeneration.

B. *Atrophy of the sweat glands.*—Diminution of the sweat glands is usually effected by decrease of the cellular elements; more rarely by diminution of volume of these elements.

The causes of the atrophy may either date from fœtal life, a defective development of the body and the cutis being associated with insufficient formation of these glands; or they may be post-natal, acquired. The latter again may be attributable to their physiological course of development, *e. g.*, senile degeneration, or be brought about by partly general, partly local pathological conditions. In persons affected with diseases of the digestive organs, and especially in those suffering from defective nutrition or marasmus, sweat glands in process of involution will be found almost without exception. Should the nutrition be insufficient only on some parts of the body, the glandular atrophy will

affect corresponding larger or smaller regions. Wheals, corns, cicatrices, etc., which diminish the blood supply by pressure on the underlying tissue and favor absorption, always cause atrophy of the sweat glands. Among etiological factors we must also enumerate the diminished activity of the nerves. For instance, on paralyzed parts of the body we find atrophic sudoriparous glands attributable not only to the cessation of active mobility, but also to the lesion of the specific nerves. This will also be the case with other nervous affections when these fibres have thereby been placed out of function. Finally atrophy occurs after inflammatory processes, degenerations, and metamorphoses of the glandular substance. It is mainly after the various inflammatory processes of the skin that hypertrophy is not rarely seen side by side with atrophy of the sweat glands.

Atrophic sweat glands, unless connected with anidrosis, are altogether of no moment.

## III. FUNCTIONAL DISTURBANCES OF THE SWEAT GLANDS.

The secretion produced by the activity of the sweat glands may deviate from the normal in two ways. It may be changed in amount (quantitatively) or in composition (qualitatively), and possibly in both ways. The former manifests itself in three degrees: by the quantity exceeding the physiological measure (hyperhidrosis, ephidrosis), falling short of it (hypohidrosis), or being completely absent (anidrosis). Qualitatively the secretion is altered by peculiar relations of the normal constituents (albumen, sugar, bile pigment, etc.), various chemical influences (decomposition products: ammonium carbonate, etc.), whereby its color, odor, taste, chemical reaction, etc., are changed.

### *A. Hyperhidrosis—Ephidrosis.*

By the term hyperhidrosis we mean habitually increased sudoral secretion, profuse sweating, extending over the whole body. If it affects only a single part it is called hyperhidrosis localis or, shortly, ephidrosis. To constitute hyperhidrosis, therefore, it is necessary that within a certain period of time, under all circumstances, more than the normal quantity of perspiration is produced. Nor are we justified in including under hyperhidrosis the profuse perspiration occurring in intermittent fever with the defervescence. The same may be said of the profuse, so-called critical perspiration in remittent fever, typhoid fever, pneumonia, etc.

*Etiology.*—Hyperhidrosis may be congenital, manifesting itself sometimes even in very young children. Er. Wilson mentions a family in which the husband and suffered from hyperhidrosis from the ninth to the fiftieth year, and the mother and two brothers were affected, while the two sisters were free from it.

In by far the greatest number of cases hyperhidrosis is acquired and may appear at any age. Although it is beyond question that the nervous influence is the determining factor in hyperhidrosis as in the normal secretion, we shall nevertheless not always be able to ascertain the cause inasmuch as it cannot be determined whether only one kind of fibres effects the secretion or whether, as Vulpian assumes, there are inhibitory besides the excito-sudoral nerves in the sympathetic. Moreover, there is still some difference of opinion as to whether the sudoral nerves are merely of sympathetic or also of spinal origin, whether they run isolated or only in company of sympathetic and not also with motor and mixed fibres, etc.

But far from being able to point to the connection with the nervous irritation as the immediate cause for all, *i. e.*, regional, unilateral, and general, hyperhidroses, there

is barely a single pathological process which always produces the same phenomena under equal conditions. In this respect I call to mind lesions of the cervical part of the cord which are followed not only by hyperhidrosis changing with the locality, but often by normal secretion or even anidrosis. Therefore, instead of grouping the causes of hyperhidrosis under special points of view and separating them from the ephidroses, we shall have to remain content with naming all diseases mainly associated with increased secretion of sweat, and only where the nervous influence is indubitable, note it particularly.

Lesions of the cerebrum, on the whole, produce disturbances of the sudoral secretion but rarely; and if so, usually a partial hyperhidrosis. The latter becomes universal occasionally in the course of morbus Basedowii. After an injury penetrating the temporal bone, Bloch observed hemilateral hyperhidrosis and, in another case of epileptiform convulsions, profuse perspirations. Bouveret had a similar experience with a gumma of the cortex cerebri. Adamkiewicz reports two cases of ataxia of one arm occurring after a cortical lesion in which profuse perspiration appeared at intervals, and in which the post-mortem showed an abscess of the cerebrum on the side opposite to the affected arm.

Conditions of cerebral depression often cause more or less developed hyperhidroses. All these phenomena point to the fact that a sudoral nervous apparatus must be present in the brain.

Adamkiewicz has observed profuse perspirations occurring with a glioma of the medulla oblongata.

Spinal affections rarely present the picture of hyperhidrosis; now and then in tabes dorsalis, also in sclerosis of the posterior horns and of secondary ascending degeneration of the cord if they are associated with increased reflex irritability and eccentric pains. Profuse perspiration is often observed with neuroses of certain nerves; for instance, in trigeminal neuralgia, where it may be present on both sides (rarely), or along one or more branches; also in occipital, intercostal, brachial, lumbar, and sciatic neuralgias.

Injuries, spontaneous or secondary inflammatory processes, morbid alterations and compression of the trunk of the sympathetic or its ganglia give rise most frequently to hyperhidrosis, chiefly unilateral. As a rule, cutaneous hyperæmia, heightened local temperature, turgescence of the skin, and, with lesions of the cervical medulla, oculo-pupillary disturbance are present.

The first acceptable explanations of these processes were furnished by Vulpian and Nitzelnadel. These were amplified since Nicati has shown that paralysis of the cervical portion of the sympathetic produces in the first stage hyperæmia, heightened temperature, and hyperhidrosis of the face, that this is followed by an intermediate stage with cessation of the perspiration, to be succeeded in the second stage by pallor of the skin, lowering of the temperature, and anidrosis.

In hemicrania, according to Du Bois-Reymond, implication of the sympathetic nerve begins with the irritated condition (vascular spasm) on one side of the head, and is followed by paresis—erythema and perspiration—of the affected half of the face. In many cases, however (Möllendorf), the symptoms are said to occur in the reverse order, still the participation of the sympathetic is unquestionable.

But ephidrosis or hyperhidrosis appears with particular distinctness in cases of compression of the sympathetic. Glandular tumors on the neck, aortic aneurisms, neoplasms, carcinomatous degenerations (Ogle), parotid tumors (Verneuil), sometimes even

the infiltration due to inflammation of the cutis (erysipelas) cause, besides hyperhidrosis, the concomitant phenomena (oculo-pupillary) of paralysis of the sympathetic.

Under this head belong all the traumatic influences affecting the sympathetic in consequence of diseases of the tissues or of injuries acting from without. Thus, for instance, unilateral hyperhidrosis has been repeatedly met with after caries of the vertebræ, also after gunshot fractures, compound fractures of the clavicle (together with paralysis of the brachial plexus). Hayem reports a case affecting the lower extremity, where, three years after a gunshot fracture, abnormal pigment and hair formation and continual perspiration were present on the leg. Particularly instructive is Ebstein-G. Fränkel's case in which ephidrosis of the left half of the head and trunk and upper extremity occurred after angina pectoris, without change in the pupil. During the autopsy there were found on the ganglia of the cervical sympathetic (especially the inferior) macroscopically visible, roundish, brownish-black spots the size of a grain of sand which on microscopic examination could be recognized as cavities (varicose dilatations) situated in the continuity of the vessels. Their interior was invested with a distinct endothelium and filled with blood-corpuscles in various states of preservation. A similar case of left hyperhidrosis is reported by P. Guttmann. It is correct to include under this same head the glossy skin (Paget) of traumatic origin, in which hyperhidrosis of the affected part is likewise present in the beginning, and is followed by anidrosis.

The observations of pulmonary and cardiac diseases associated with hyperhidrosis remain obscure. Gubler had long ago noticed the perspiration and the occurrence of deeply flushed cheeks appearing with severe pneumonia. Since then the combination of valvular lesions, cardiac hypertrophy, and often even simple palpitation of the heart with unilateral perspiration has been pointed out by Fleischmann, Seeligmüller, and other observers. From the latter phenomenon, as well as from the frequent presence of the other symptoms peculiar to paralysis of the sympathetic, it may be argued with considerable probability that here the same lesion may exist. The excessive perspiration in phthisis certainly belongs here, only it is specially increased by the general debility, slight nervous excitement, and the depressed state of mind. The fatty degeneration of the glandular epithelium first discovered by Virchow is to be considered as a sequel.

In hysteria and menstrual anomalies, hyperhidrosis or ephidrosis is rather frequently present. It is hardly ever absent at the menopause. I think that here, too, paralysis of fibres of the sympathetic may be assumed.

In connection with the preceding, we shall briefly refer to Aubert's results in some cutaneous diseases. A. has attempted to represent the sudoral secretion plastically in an ingenious manner,[1] and has obtained the following results. In ichthyosis increased perspiration is said to be present when the disease has a superficial seat, otherwise there will be hyphidrosis. Purpura shows on the hemorrhagic spots suppression of the secretion, while in their circumference it is increased. The same is true of cicatricial spots when the sweat glands have perished. In nævus spilus hypersecretion is found because, according to A., hypertrophy of the tissues is associated with that of the sweat glands. On the hyperæmic skin around deep-seated abscesses, wound surfaces, etc., hypersecre-

[1] To this end it is suggested to fasten a piece of thin white paper lightly to the part whose secretion is to be ascertained, for about one or two minutes, and after the drops of sweat—for instance, produced by pilocarpine—show themselves on the paper, the latter is carefully lifted off, drawn through a 0.5 per cent solution of silver nitrate, and then exposed to the light. By the negative impressions obtained in this manner, which are compared with results gained from other healthy parts of the skin, it is possible to get information as to the quality of the secretion.

tion is said to be present, while on parts affected with erythema balsamicum, roseola syphilitica, etc., the secretion is normal. In prurigo, psoriasis vulgaris, eczema, herpes, zoster, pemphigus, the secretion is redueed, in erysipelas completely arrested; it returns on recovery, though only after two weeks in erysipelas.

*Symptoms, Course, and Termination.*—Perspiration is not an indifferent secretion despite the small quantity of solid eonstituents (0.5 to 2.5 per eent). When occurring moderately and temporarily, it gives rise to an agreeable sensation by cooling and lubricating the skin.

It is different when the perspiration appears in excess and with but slight intermission; when it annoys anæmic and cachectic persons after slight effort, and if, as in phthisis, it continually bathes the skin. In such cases, not only the causative factor of the perspiration, but also the relation of the sweat to the cutis is of importance.

To be sure, we do not know the relation between the consumption of material and the production of perspiration. But even admitting that the latter is really unimportant on account of its few solid constituents, still the profuse perspiration cannot be unimportant by reason of the great loss of water and the nervous excitement, even if but partial, connected with it. Hence we find, too, that such patients, already debilitated by the primary affection, are weakened still more by the abundant perspiration.

But the hypersecretion manifests itself also by local effects. In such an event the skin, at the uncovered places, is kept clean with difficulty, always feels unpleasantly cool, and, in more delicate persons, the epidermis is macerated. This is true in a still greater degree when the evaporation is hindered by the covering of the part and the various organic and inorganic materials remain there. The latter not only attack the epidermis, but provoke inflammatory symptoms associated with itching, chiefly eczema.

The most striking example of the consequences of general hyperhidrosis is offered by (*a*) sudamina.

In summer this eruption attacks chiefly fleshy persons who are dressed rather warmly or who are very hirsute and are forced to work in the heat of the day; in the winter it attacks workmen, especially artisans whose shop is very hot, particularly at night. The eruption begins with violent itching, soon extends over the greater part of the trunk, consists of closely aggregated nodules, vesicles, or pustules the size of a pin's head, which appear in fresh crops for several days, and finally the several efflorescences dry into small crusts. This inflammatory cutaneous disease may change into a fully developed moist eczema if the injurious factors persist or if unsuitable irritating appliances are made. But if care be taken that the body do not perspire much, if every other injurious influence be guarded against and the skin kept dry, the efflorescences retrogress, and, the crusts and detached epidermis being cast off, the process is completed within a week.

(*b*) *Miliaria.*—This affection has been regarded as a special form of disease which frequently arises in the train of other, generally febrile, maladies.

As in the acute infectious diseases, writers distinguish three stages of the process. The prodromal stage is characterized by malaise, loss of appetite, depression of mind, suddenly followed by chill or rigor, succeeded by heat. At the same time the patient suffers from severe headache, often lapses into unconsciousness, has syncope, epistaxis, a feeling of oppression on the chest, heaviness of the stomach, nausea, pain in the back and loins, numbness of the finger tips, cramps in the calves, and constant jactitation. This condi-

tion having lasted from several hours to ten or eleven days, the second stage of the disease, *i. e.*, the eruption, is said to occur with or after profuse perspiration. A large number of nodules and vesicles from a millet-seed to a lentil in size appear on the skin of the neck, the breast, the gastric and abdominal regions, the extremities, and the back, but never in the face; often fresh crops break out for several days. The several efflorescences become only exceptionally confluent. The eruption has no influence on the duration or intensity of the fever. This is followed after a few days by the third stage in which the efflorescences dry up and the small scales formed are shed without leaving a trace behind. However, the process, *i. e.*, the fever and the morbid state of the organs or of the whole system, may advance or retrogress independent of the cutaneous lesion. As far as I could ascertain, there are no reliable post-mortem examinations of persons dead of miliaria. The affection is said to occur at all seasons, but more frequently in cool rainy than in warm dry weather; to spare no age, though children and old people are more rarely attacked; and to exempt neither sex nor station. Nothing definite can be learned as to predisposing factors or causes. Opinions differ also about the infectiousness of the disease; some writers hold it to be not all or but rarely transmissible, and ascribe the epidemics, usually occurring in remote country places, rather to uncleanliness and unfavorable hygienic conditions generally. Plouviez claims to have observed several cases without eruption (suette sans éruption) during a miliaria epidemic.

If we review once more the whole series of symptoms in order to ascertain what is contained in the above descriptions essential to miliaria, what is the most prominent factor in the course of the disease given, and what it is that bears the impression of a peculiarity, we must confess that we are unable to find anything of the sort. At all times there have been physicians who have looked upon miliaria only as a symptom or even merely as an accidental occurrence, owing to its appearance with the most heterogeneous diseases. Thus Kreysig asks, "should not the miliary eruption, especially that associated with epidemic diseases, be considered a symptom, due to a consensual irritation of the skin?" Others deny the possibility of an independent miliary fever altogether, and look upon the miliary exanthem and fever as two sequels unconnected with each other. This is the standpoint taken by the great majority of clinicians at the present day. The points of difference at present existing refer to the immediate causes of miliaria. Ferd. Hebra is inclined to look upon "the occurrence of the eruption in each case as a product of a pyæmic process." Trousseau and his school assume a twofold, an idiopathic and a pyæmic origin. I for my part willingly admit that miliaria frequently occurs in the train of a pyæmic and of a febrile process generally, but cannot concur in the belief that it should be brought into direct causal connection with the latter.

*Definition.*—In my opinion, miliaria is a sudoral eruption appearing chiefly in the course of febrile diseases, and consisting of clear, dewdrop-like vesicles from a millet-seed to a pea in size; its occurrence is connected not so much with the kind of the fundamental affection as with the possibility of the predominance of the glandular secretion.

*Course and Termination.*—A febrile state having existed for several days, a crop of the above-described isolated vesicles breaks out, without any special prodromata, on the neck, trunk, or the inner surface of the extremities; the base and circumference of the vesicles show no abnormality. The contents of recent efflorescences always have an acid reaction and include only here and there a lymphoid corpuscle or an epithelial cell. A. Vogel has also found chlorine salts. When the vesicle is fully developed, it no longer enlarges; the only change it undergoes is that, as the contents evaporate, the cov-

ering epidermis becomes wrinkled, and after from two to four days the entire vesicle finally dries into an insignificant scale which is shed without leaving a trace. The duration of a single efflorescence is at most a few days, but the eruption in general may last one or two weeks on account of relapses. It has no influence whatever on the course of the primary affection.

*Diagnosis.*—Its delicate, dewdrop-like, always limpid appearance, the absence of alteration in the surrounding skin, characterize it sufficiently. It may escape notice when the efflorescences are so insignificant as to be felt better than seen.

*Differential Diagnosis.*—The pustules due to pyæmia and septicæmia most frequently give rise to mistakes. But if we bear in mind that in the latter the contents of the efflorescences are always purulent, that they occur scattered over the whole body, the differentiation will not be difficult even when both eruptions appear simultaneously. Similarly, the irregular aspect and occurrence of the bullæ in erysipelas will leave no doubt as to their correct interpretation. There may be greater difficulty in the case of pemphigus or febris bullosa. For in both diseases the eruption is preceded by fever, the efflorescences are confined to isolated parts of the body, and have a similar course and termination. But it will be observed that the bulla of pemphigus usually springs from an erythematous base, that its average size is larger than that of miliaria, and that in pemphigus every relapse is heralded by an exacerbation of the fever, while in miliaria these two conditions will coincide only by accident.

It will be mistaken for sudamina only in case there is a misconception as regards the differentiation of miliaria generally. In many works on skin diseases the two forms of eruption are still insufficiently separated. There are references to miliaria rubra when the surrounding cutis is reddened; to a miliaria alba lactea, when the contents of the vesicles are whitish turbid and the surrounding zone is normal or pale by reason of maceration of the epidermis; and to a miliaria crystallina, when the inclosed fluid is clear and transparent like water; the former two eruptions are typical sudamina, and the latter only is entitled to the name miliaria.

*Treatment.*—The best method of treatment is to leave the eruption alone. Should it occur at a place where it is annoying, the drying may be hastened by frequent dusting with starch, lycopodium, talcum, alone or mixed with oxide of zinc, cream of tartar, or salicylic acid in the proportion of 1 : 30 to 50.

2. *Ephidrosis.*—While considering the etiology of hyperhidrosis, owing to the inseparability of general from unilateral and regionary hyperhidrosis, we were repeatedly forced to refer to the latter. The same cause—let us assume, for instance, a lesion of the sympathetic—according to its seat and duration, and sometimes without ascertainable reason, will produce sometimes a diffuse, sometimes a partial hyperhidrosis.

*a. Ephidrosis Vola Manus.*—Excessive sweating of the palms of the hands is one of the most frequent local hypersecretions. This becomes particularly noticeable in midsummer, when the abnormally increased secretion is still more augmented and the factor of continual evaporation is superadded. Such a hand sometimes feels clammy and sticky; sometimes again remarkably warm when the perspiration temporarily remits. On inspecting the palm, especially if the epidermis is not thickened, we notice even on the lateral parts of the fingers vesicles from a pin point or poppy-seed to a lentil in size, isolated, close together, or confluent (when they may reach the size of a cent) with clear watery contents; still more frequently, the vesicles have ruptured, the epidermis being lacking at their centres, while the periphery is limited by an irregularly fringed border.

Ephidrosis of the palms occurs almost exclusively in anæmic children and chlorotic,

dyspeptic, and cachectic adults, in women more frequently than in men. It usually affects both hands, but sometimes only one ; it may remain unchanged for years, or temporary remissions and exacerbations may alternate. Frequently the tip of the nose—usually unheeded—and the soles of the feet are likewise subject to the same affection.

*b. Ephidrosis Pedum.*—The feet sweat much more than any other part of the body. Feet or soles of feet affected with profuse perspiration are moist even when uncovered and after but slight exertion make the impression as if they were bathed in sweat. On inspection, their whitish, dull, lustreless appearance, due to the macerated, loosened epidermis, is striking. When the hyperhidrosis has reached a higher degree and is of longer duration, irritation will be caused by the decomposed secretion, and by the shoes, the dust, etc. The simplest form of this irritation manifests itself by scattered painful red spots often occupying the larger part of the sole. Should the process advance, there is formed, just as on the palms of the hands, detachment of the epidermis of variable extent, due to the accumulated fluid, and the epidermis becomes still more undermined if the same causes continue.

*Dyshidrosis* (T. Fox).—In two cases of excessive perspiration I had an opportunity of becoming acquainted with quite a peculiar affection of the skin. Two middle-aged healthy men (college teacher and cattle dealer) sought my advice for painful sweaty feet. In the case of the cattle dealer, the soles of the feet were so sensitive that he had been unable for some days to wear any kind of shoe. On inspection the maceration of the epidermis of the whole foot and the partial reddening of the sole were very striking. Here and there the epidermis, without being noticeably lifted up, looked lighter in the deeper layer. On puncturing these spots, a small quantity of viscid or limpid pus oozed out. But that the same fluid had more extensively undermined the thickened corneous layer was unmistakable. This supposition was verified when the points of the scissors were pushed in sideways from the first puncture. By the side of these undermined patches of epidermis could be seen purulent elevations, pustules, or, where the latter were deprived of their covering, extensive denuded spots of the rete, from a lentil to a walnut in size. At the periphery of the efflorescences pus was present under the epidermis, and there was a stubborn tendency to further purulent infiltration. A similar process, only of slighter degree, had been present in the second patient for six years. The frequent use of foot-baths, careful trimming of the undermined epidermis, and the continual employment of diachylon ointment in the usual manner were followed by complete recovery in from four to six weeks.

T. Fox was the first to recognize this affection, and described it in 1872 under the name of dyshidrosis. According to this author, it is due to the retention of excessive perspiration under the epidermis. Hutchinson has termed the same affection cheiropompholix, and Robinson, pompholix ; both explain it as a kind of pemphigus. This view appears to me altogether erroneous, if it be true that the process which I have observed is the same.

*c. Hyperhidrosis in axilla.*—Excessive perspiration in the axilla is of frequent occurrence. Often it is associated with diffuse hyperhidrosis, at other times with some ephidrosis, but it is equally frequent alone on both sides, or else on only one. Excepting the anatomical relations, *i. e.*, the superficial seat and generally numerous glands, which must be interpreted as predisposing factors, we still lack all knowledge as to its cause. From the presence of bacteria in the red axillary perspiration Eberth argues their causal connection with hypersecretion ; my investigations, however, failed to convince me of the truth of this explanation.

The noticeably increased perspiration in the axilla of undressed persons is explained by Aubert in this manner: by the uncovering of the body the temperature in the axilla and at other similar parts, *e. g.*, the perineum, is raised 0.5° C., and, supported by the many sweat glands, this unusual hyperhidrosis then occurs.

Hyperhidrosis of the axilla betrays itself by the continual moisture, staining of the linen, and the frequently penetrating odor. Eczema frequently results at this part of the body if not kept clean and dry.

*Treatment of Hyperhidrosis.*—The therapeutic results obtained hitherto are of a subordinate or even doubtful nature as regards the direct, reliable removal of the hyperhidrosis. In substantiation of these remarks I shall cite the mode of action of atropine sulphate. I do not wish to be understood as saying that this drug (given in doses of 0.0015 to 0.003 Gm. a short time previous to the outbreak of the perspiration) is ineffectual; on the contrary, I believe that in profuse, especially night-sweats, as in phthisis, it moderates the perspiration for some time or possibly stops it altogether; but this effect is not always secured, is generally but temporary, purely palliative. Equally reliable, temporarily, as an antisudorific is white agaric (0.1 to 0.5 Gm.), also extract of aconite (0.03 to 0.06 Gm.), salvia leaves (Van Swieten), flor. sambuc. nigr., aqueous extract of strychnine (0.02 to 0.01 Gm.). The internal use of carbolic and salicylic acids is likewise said to have been effectual.

However, it seems to me more correct to adapt the treatment to the individual case, and hence the first task of the physician should be to ascertain the nature of the perspiration. In pronounced morbid conditions, the latter should receive the first consideration, as in diabetes mellitus, affections of the lungs and heart, morbus Basedowii, hysteria, migraine, neuralgia, etc. Should such pathognomonic factors not be demonstrable, we must ask ourselves if there be no masked constitutional affection—anæmia, chlorosis, scrofulosis, syphilis, cachexia, etc.—and if so, we should endeavor to counteract it effectually by corresponding roborants, arsenic, quinine, iron with arsenic, or specifics.

After these indications have been met, we may, according to the requirements of the case, resort to the above remedies, as well as to others recommended as specifics by various authorities; also, to electricity, lotions and baths of vinegar, tannin, corrosive sublimate, or solutions of salicylic acid (0.2–3 per cent); or else, to the various dusting powders which are said to act partly hygroscopically (amyl. tritic., talc. ven., sem. lycopodium, etc.), partly as antihydroa (salicyl, thymol, benzin). But in every case we must be guarded in our prognosis, and not be too sanguine as regards the result.

In the local hyperhidroses the prospects are in general more favorable.

Medical advice is sought most frequently with regard to those parts whose increased perspiration causes the greatest inconvenience, viz., the hands and feet, the axillæ and genitals. In these cases, too, unless we wish to rely on spontaneous recovery, we have to be guided in our treatment by the elucidation of the etiological factors. The parts in question should be protected as much as possible from all those influences which normally favor perspiration. Thus persons inclined to perspire excessively should not wear dark, heavy clothing in summer; the rubber or oil silk dress protectors applied to the arm-holes of female attire must be laid aside: linen should be worn next the skin; and the foot coverings—stockings, shoes, etc.—should be light and be frequently changed. Locally, watery and alcoholic lotions and dusting powders should be applied. For the slighter forms of ephidrosis the following drugs, used in the manner stated, are appropriate: Acid. tannic. pur., 1 : alcohol, 200; hydrargyr.

bichlor. corr., 1 : aqua, 350; sodium ammoniat., extr. aconiti, colombo, 1 : aqua, 200; aqua coloniensis æther., and other diffusible and volatile fluids. All these remedies are to be applied to the perspiring spot several times daily by means of a sponge slightly pressed on, allowing them to evaporate or dry in a current of air. In perspiration of the hands and feet, the drugs may be employed as ingredients of local baths. After this procedure, especially the alcoholic lotions, the patient experiences immediate relief, and in order to maintain this as long as possible, it is advisable to use dusting-powders. The latter are composed of amylum tritic., oryzæ, talcum venet., rad. ireos florent. pulv., sem. lycopod., etc., to which are added as auxiliaries zincum oxid., plumb. carbon., acid. salicyl., potass. bitart. (0.5 per cent). To the interdigital folds and other parts which are in contact we may apply pledgets of lint strewn with one of the above powders; but they must be changed whenever they become moist.

The most difficult task is to relieve profuse perspiration of the feet. In the slighter degrees it is possible that one or other of the above procedures may suffice; in the graver forms success is rare; and this is also true of the substances recommended as antiparasitics (Thin: boracic acid). Thus far we know of but one mode of treatment devised by Hebra which is unequalled, namely, the methodical employment of diachylon ointment. To this end the foot is first washed clean, carefully dried, and then enveloped in a close fitting, clean, rather dense linen rag of appropriate form and size, which is spread with the well-known diachylon ointment to about the thickness of the back of a knife. In order to enhance its effect, pledgets of lint are laid between the toes. As the ointment should remain in continual contact with the skin, it is desirable that the patient should go to bed and either wrap the foot in flannel, or, if his occupation forces him to be up, to cover the foot with fresh stockings and shoes. After twenty-four hours, the linen rags are removed, the ointment remaining on the skin is gently wiped off with oil, and the foot dressed in another linen rag as before. This procedure is repeated in the same way for one or two weeks, and at the end of that time the foot is dusted thickly several times a day, especially at the transitional spots and between the toes, and kept scrupulously clean. While the patient was not allowed to take a foot bath during the entire treatment, he should be encouraged to do so thereafter. The symptoms appearing immediately after the treatment consist in exfoliation of the epidermis in large yellowish-brown flakes thickened by the application of the ointment, exposing a delicate light pink or pale epidermis. As a rule, after a single course of this treatment the ephidrosis ceases for some length of time, only exceptionally is it necessary to repeat the procedure two or three times before the object is attained.

## B. HYPOHIDROSIS AND ANHIDROSIS.

Complete loss of the sudoral secretion is a rare occurrence, excepting on circumscribed spots where the sweat glands have perished with the destruction of the more deeply seated connective tissue; or on those where inflammations of the glands have been followed by atrophy, degeneration, occlusion of the opening and the duct (retention cysts); or on those where homœoplastic and heteroplastic new-formations appear and paralytic conditions arise in consequence of nerve lesions. Generally the perspiration is merely slower and less than normal; but these factors suffice to impart to the skin a dry, parchment-like rough feel. But we should speak of an anhidrosis only to a limited extent, for as a rule we are not dealing with this affection, but with decreased perspiration, hypohidrosis.

Hypohidrosis, like hyperhidrosis, may be general or local. The tendency to it may be congenital or acquired.

A general diminution of the sudoral secretion is rather frequently observed in a number of internal diseases, among others in such as are often associated with hyperhydrosis, as diabetes mellitus and insipidus, tabes dorsalis, elephantiasis Arabum and Græcorum, psoriasis, lichen scrofulosorum, neoplastic cachexia, and even in phthisis.

But their most appropriate territory is always furnished by the various neuroses. Thus far we are in possession of but a small number of cases of anhidrosis in which a demonstrable participation of the peripheral nerve trunks could be found; for instance, in paralyses due to traumatic or mechanical lesions of the brachial, lumbar, or other plexuses. In all these cases arrest of perspiration persists until the galvanic excitability of the nerves is restored. A no less certainly established factor is furnished by the glossy skin, finger, etc., due to caries of a tubular bone, in which, early in the implication of the nerves, there is present pronounced hyperhidrosis. And in proportion as the paralysis develops, the secretion becomes less until it finally ceases.

The most pronounced picture of a paralytic anhidrosis is presented by the hemiatrophy of Virchow, in which all the tissues atrophy down to the bones. With such trophoneurotic disturbances of the skin we observe numerous other neuropathic symptoms, such as oft recurring inflammatory eruptions (eczema, herpes, and others), early loss of the hair, etc. It is evident that there is present here some implication of the facial nerve, but it is unknown as to what extent the trigeminus is implicated, and whether the hypoglossus does not likewise participate. The same fact is observed in infantile spinal paralysis, in which the sudoral secretion returns with the galvanic excitability of the nerve, with the recurrence of active mobility, and the nutrition of the extremity.

Hypohidrosis or anhidrosis forms an almost constant symptom in the sequels of diffuse myelitis and poliomyelitis. Strauss and Bloch hold this symptom to be of such importance that they use it as a differential diagnostic sign against paralysis of cerebral origin.

In affections of the sympathetic, we shall encounter hypohidrosis only in the case of irritations, usually due to mechanical or traumatic lesions. But this coincidence is not so constant as to enable us, in settling the diagnosis, to dispense with other symptoms of the neuro-paralytic condition, such as spastic mydriasis, pallor and reduced temperature of the skin, etc.

In general, therefore, we can say that, in so far as hypohidrosis is of nervous origin it is due, in the first place, to lesions of the anterior horns of the gray substance, very often to those of the motor nerve trunks and even their terminal portions (Leloir), and here and there to those of the posterior horns and some parts of the sympathetic.

The prognosis and treatment of anhidrosis always depend on the primary affection.

### C. QUALITATIVE CHANGES OF THE PERSPIRATION. PARHIDROSIS.

The impossibility of obtaining the perspiration which has come to the surface in an absolutely pure condition makes it difficult to determine its normal constituents. How much more difficult will this be under pathological conditions, where there is an increase or diminution of the normal ingredients, an admixture of abnormal substances. Thus, it is well known that in anuria from nephritis cholerica and scarlatinosa the excretion of urea on the surface of the skin is augmented to such a degree that after evaporation uric acid crystals often remain behind over extensive regions, while the quantity of the same

substance may sink to barely perceptible traces during the defervescence of a high fever and after profuse sweats. The same is true, under certain conditions, of the fatty volatile acids and the salts.

A large number of other substances have been found at times in the sweat, viz.: grape sugar (in diabetes), traces of albumen in the form of serum albumin, lactic acid, cystin, bile pigment, indigo, and other chromogens. Besides, a transudation after the ingestion of drugs has been proved; for instance, iodine after potassium iodide; sublimate after iodide of mercury; arsenious acid after arsenate of potassium, arsenic acid after arsenate of sodium and arsenuretted oxide of iron, copper after copper poisoning, hippuric acid after benzoic acid (H. Meissner, disputed by G. Meissner), tartaric acid.

It is to be expected that continued experiments and investigations will show that there are still others.

We distinguish the following qualitative anomalies of the perspiration.

1. *Chromidrosis* (Colored Perspiration).—In general this term is understood to mean every colored perspiration, whether it be yellow, red, dark-brown to black, or green. An exception is made only in the case of the blue perspiration for which a special title is employed—cyanhidrosis.

The originator of the term chromhidrosis, Le Roy de Mericourt (1858), published several cases that came under his observation, and subsequently (1864) endeavored to demonstrate the altered perspiration to the profession by instituting histochemical investigations (Ch. Robin). But owing to the fact that some eminent French clinicians met with mystifications by hysterical simulators (by means of plumbago, silver nitrate), doubts were raised as to the very existence of chromidrosis. However, within the last two decades, several cases have been described by observers whose trustworthiness does not admit of the least doubt.

I have hitherto had no opportunity of seeing a case of chromhidrosis, and therefore I must restrict myself to recapitulate the data which appear to me most credible. It is said to occur chiefly in females who are suffering from hysteria, menstrual anomalies, chloræmia and anæmia, with their associated nervous affection. Hardly a dozen cases have been observed in men, and then under the most heterogeneous conditions (hypochondriasis, phthisis, syphilis, etc.). Blue perspiration has thus far been most frequently met with, though the red, yellow, and black are not so very rare relatively. Chromhidrosis may occur on any part of the body, but has been observed most often on the lower eyelids, the forehead, cheek, abdomen, and, in men, mostly on the scrotum. The affection is equally frequent in summer or in winter. Its duration is not limited, sometimes lasting continuously for years, sometimes, with one or more relapses, disappearing for days, weeks, or years. It appears either on a small circumscribed spot or a more extensive surface, where it manifests itself, on the one hand, by a fine dust-like deposit, on the other, by discoloration of the epidermis and even of the lanugo. On such places, then, we see longer or shorter, straight or circular streaks of discoloration, which can be removed only with difficulty by rubbing with oil, glycerin, or by scraping. To guard against deception, Spring recommends the following procedure. The spot to be examined is carefully cleansed with oil, and when perfectly dry, collodion is painted on in a thin layer and allowed to remain for a few days. When chromhidrosis is actually present, it will show itself when the collodion pellicle is lifted off.

Foot believes that the color is due to oxidation of hæmatin, but chromidrosis is generally looked upon as the product of the sweat glands, and its occurrence is pre-eminently the result of nervous influence. Hence it is met with wherever nervous affections

manifest themselves. The views in reference to chromogen are not so harmonious. Ch. Robin and Ordonez, who examined a sufficient quantity of blue perspiration, found therein very minute, homogeneous corpuscles of irregular shape, which in thin layers had a color approaching that of indigo, but in thicker layers were darker and opaque. Concentrated sulphuric, nitric, and acetic acids are said to dissolve the pigment only gradually when hot. Accordingly, they consider this substance to be equivalent to that found by Bizio in the urine in cyanuria, and derive its origin from the epithelium of the sweat ducts. Schwartzenbach found that the extract made from the impregnated linen by means of alcohol was colored red by mineral acids and green by alkalies. From this fact S. deduces the presence of a substance equivalent to the pyocyanin in blue pus. In Collmann's case of cyanhidrosis, Scherer's examination showed the presence of phosphoretted oxide of iron. Bergmann, in the case of scrotal cyanhidrosis, found on the equally discolored epidermis cells, chains of intimately interlaced conidiæ of a mycelium fungus which, when cultivated on paste, developed into a fungus resembling aspergillus. Experiments at impregnating pus with the blue flakes of epidermis failed altogether, nor did the chemical reactions furnish any information. C. B. Hoffmann found indigo in the blue perspiration of a paraplegic man of seventy-two, while the examination of two cases of red perspiration yielded no result except the presence of an "apparently amorphous mass." Eberth found bacteria both in normal and in "yellow" perspiration; Babesiu likewise found in the "red" perspiration of the axilla a form of fungus resembling bacterium prodigiosum, and states that the red color of the sweat stands in direct relation to the increase of this bacterium, and that red perspiration is transmissible.

2. *Hæmathidrosis, Bloody Sweat.*—It was not until the middle of the present century that the meaning of transudation of blood through the intact skin began to be appreciated, by being brought into connection with the sweat glands and declared to be an anomaly of secretion (Gendrin). *A priori* it must appear improbable that these glands had anything to do with the elaboration of a fluid which, according to exact investigations, contains red and colorless blood-corpuscles, as well as fibrin in a similar manner as blood. The improbability of such a secretion is materially supported by the clinical facts. Whoever has seen cases of so-called hæmathidrosis will recognize that in a number of such persons there exists a strong tendency to rhexis of the vessels, and that as a rule other abnormal hemorrhages occur on the mucous membranes and internal organs. Furthermore, it is established in nearly every case that physical or mental emotions preceded the attack, and that the latter is ushered in by local processes. Some neuralgia, hyperæsthesia, itching or other disturbance of sensibility is present at the point in question, or else, without any altered sensibility, there appears a local hyperæmia, a swelling, often even some discoloration of the surroundings; then an exudation, flow, or jet-like (2 mm. high, Hebra) stream of a bright red or, according to the admixture of serum, pale-red fluid issues from the pores. To be sure, all these factors do not altogether exclude the possibility that the sweat glands take an active part therein; still some suspicion as to the causal relationship must be roused by the fact that a like fluid often comes to the surface at the same time from the mucous membranes; that the process can frequently be excited by local mechanical influences; and that it is by no means permanently confined to one place, but appears now here, then there, usually where the skin is more delicate, *e. g.*, the ungual phalanx, face, flexor and inner surfaces of the extremities. Moreover, some authors believe that hæmathidrosis invariably appears only on places affected with furuncles or other inflammations, while we have seen above that these

behave anhidrotically. Ebers states that in the case under his observation small lacerations of the epidermis could be seen. It is reported, too, that hæmathidrosis, in the slighter cases, lasts barely some seconds or minutes, and in the graver, one to two hours; that it may often recur at irregular intervals, even throughout many decades (Ebers). It spares neither age, state, nor sex; but it has been noticed to be relatively rare in men (thus far only three cases), and more frequent in women, especially about puberty or when affected with hysteria, dysmenorrhœa, etc. Parrot, one of the most ardent defenders of hæmathidrosis, even admits that it is traceable to central or peripheral local nervous affections, and hence chiefly met with in hysteric, dysmenorrhœic, chloro-anæmic women and paraplegic, paralytic, or hypochondriac men; but maintains in the main that it belongs to the same category as hæmaturia e nephritide. These statements are opposed by others showing that in cases affected with hæmathidrosis absolutely no morbid change could be observed. We willingly admit that the occurrence of this miscalled hæmathidrosis is certainly connected with nervous conditions. For every physician is familiar with the fact that in hysteria, for instance, vasculo-dilator hyperæmias result from the slightest causes, either directly or in a reflex manner. Should such a person have besides a predisposition to friability of the vessels, hemorrhages of various degrees and from different organs will result easily enough. But the sweat glands, being surrounded by a very plentiful vascular network, will not be able to escape this process which is traceable to a nervous origin. Therefore, an exudation of blood may occur in one or more organs and affect the sweat glands merely by accident; or else, what is still more likely, may simultaneously take place also in other tissues and organs. And, indeed, this fact has been clearly shown by Foot's collection of the cases of hæmathidrosis thus far reported; for in the majority of these, other hemorrhages or the tendency thereto were present. Accordingly, I look upon hæmathidrosis as an exudation of blood from the sweat pores which is incited by the sympathetic and brought about in consequence of neuro-paralytic hyperæmia of the vessels appertaining to the sweat glands (by diapedesis and sometimes by rhexis).

The hemorrhages from the sweat glands, being insignificant, are not deleterious to the organism.

3. *Osmidrosis, Bromhidrosis, Fœtid Perspiration.*—The perspiration, on account of the volatile organic acids it contains, possesses an odor which is perceptible in various degrees. But whether the Laplander really smells of whale oil, the Malayan of olive oil, etc., and what may be the cause of it, I am unable to determine in the absence of personal experience. However, sometimes the perspiration has quite a penetrating odor even in persons of the Caucasian race. It is customary to ascribe this to neglected care of the skin, which is said to cause on the perspiring parts a decomposition of the secretion and a corresponding formation of free volatile fatty acid. There can be no doubt that in most cases of bromhidrosis this is really the fact, but it is equally certain that there are also persons who are affected with offensive perspiration under all circumstances. Should the affection occur on the feet or the axillæ, we are very likely to refer the irremovable odor to the impregnated apparel, shoes, etc. However, this explanation will not suffice when the bromhidrosis occurs elsewhere. Thus I had under treatment a patient who otherwise did not show the least traces of bromhidrosis, but whenever he began to perspire more freely, as after eating and drinking heartily or by active exercise, so offensive an exhalation spread around him that he was forced to shun all social intercourse. Baths, cold ablutions, and hydrotherapeutics continued for weeks produced no improvement.

It appears to me more correct, therefore, in cases of this nature, to seek the cause of the bromhidrosis in the quality of the perspiration. Hence I cannot side with those who would allow the existence of bromhidrosis only in the sense of an artefact, a secondary product of decomposition. On the other hand I am far from admitting that, in general, the perspiration in red-haired persons has a peculiarly disagreeable odor; in parturients, a sour; in syphilitics, a sweet; in rheumatics, a musk-like odor; *i. e.*, differing according to the form of disease. Accordingly, we shall act correctly and in the interest of the patient if, in cases presenting penetrating exhalations, we endeavor to trace the sources, in order, at least, to counteract the annoyance by avoiding eventual injurious influences.

4. *Urhidrosis, Urinous Perspiration.*—The urinous odor of certain forms of perspiration had been noticed already by the ancient physicians and termed by them "sudor urinæ or urinosus." Unfortunately we have thus far no record of any examinations which would be apt to elucidate the quality of urinous perspiration. All we know is that, owing to the antagonism existing between the secretion of urine and the elaboration of sweat, during the impairment of the former the latter is likewise materially altered. While in the normal perspiration the quantity of urea varies from 0.0428 Gm. (Favre) to 1.55 (Funke) per thousand, it is so greatly increased in that of cholera, parenchymatous nephritis, uræmia, etc., that, after evaporation of the generally very profuse secretion, it remains on the surface of the skin in the form of a crystalline pulp which is easily scraped off. It is impossible to state for the present whether other nitrogenous substances, traces of which are met with, are likewise augmented. In regard to the inorganic constituents (phosphate and chlorides), we may conclude with the greatest probability that they are diminished in urhidrosis.

The strongly urinous perspiration is probably due in the first place to the generally increased elaboration of sweat on account of special conditions, and in the second place to the absolutely augmented excretion of urea, as well as to the inevitable presence of decomposition products, *i. e.*, particularly the carbonate of ammonium, aided possibly by the fatty volatile acids (formic, butyric, acetic, and other acids).

# THE PARASITIC DISEASES

# OF THE SKIN.

BY

A. WEYL, M.D., AND PROF. GEBER, M.D.,

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## I. SKIN DISEASES DUE TO VEGETABLE PARASITES (DERMATOMYCOSES).

BY

A. WEYL, M.D.

It is only within the last forty years that the causal connection of the pathological processes in question with the existence of a fungus has been disclosed.

Thus in 1839 Schönlein[1] was the discoverer of the achorion of favus named after him. A few years before Schönlein, Remak had asserted that the favi are not composed of the same elements as other pustules; but Schönlein first demonstrated the fungus and called it oidium, which name Remak subsequently changed into achorion Schönleinii. It was not long before investigators endeavored to explore the disease in all directions by inoculating the fungus on themselves, on others, and on animals, as well as by its artificial propagation in suitable nutritive fluids.

The falling of the hair was accounted for by Gruby[2] by the fact that he had seen, though rarely, the threads of mycelium extend into the roots of the hair; thereby the hair was said to soften and split longitudinally. Subsequently Wedl,[3] after treating it with concentrated potash lye, found in the interior of the hair, a little way above and below its emergence through the skin, threads of mycelium which, however, did not penetrate as far the root. G. Simon,[4] in his sections of the skin affected with favus, saw the fungi only rarely penetrate downward between the hair and the interior root sheath; in most cases they extended merely as far as the opening of the hair-follicle. He never observed them to reach down to the root. To explain the cutaneous atrophy, G. Simon as-

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[1] "Zur Pathologie der Impetigines." Müller's Arch., 1839.

[2] Müller's Arch., 1842.

[3] Ztschr. d. k.k. Gesellsch. d. Aerzte zu Wien, 1849, p. 643.

[4] "Hautkrankheiten," 1851, p. 330.

sumes partial wasting of the substance of the cutis by inflammatory-hyperæmic conditions of the skin, as well as by mechanical compression by the felted fungus growing downward.

M. Kaposi[1] states that he had seen, in hair extracted from favus patients, threads of mycelium in the hair bulb and the root sheaths, as well as in the hair itself above its emergence through the skin, although he admits that the cuticula of the hair may for a great length of time energetically resist the penetration of the fungi.

Götte[2] found "that in favus the growth of most of the hairs is not interrupted, but only their advance through the skin, so that the shaft, steadily increasing in length, winds in irregular bends within the inner sheath (the inner one is soon lost) without our being able to speak of adhesions at the several points of bending."

Remy states that in favus the fungus is seated only between the two epidermis layers and frays out the hair without penetrating into it. From the corneous layer the fungus extends into the papillary layer. The scutula of favus may give rise to lymphangitis. The conidia do not penetrate into the vessels.

According to Hoggan, the achorion penetrates between the epidermis and the connective tissue part of the hair-follicle, separating the two layers. In round plates it grows into the surface, and destroys the connective tissue portion of the hair-follicle and of the root sheaths. The fungus grows into the corium with sprouting forms of spores, the falling elements of which form the crusts.

Unna[3] found, on examining a piece of scalp with favus which had been preserved for several years in alcohol, that both the hair bulb and the entire external root sheath, as well as the whole prickle-cell layer of the rete, are altogether free from fungi, while already at the point of exit of the hair (funnel of the hair sac) the fungus, proliferating only in the corneous cell layer, penetrates both into the cuticula upward and downward with destruction of the medulla and cortex, and into the internal root sheath. The hair shaft has lost its smooth contour; it is as if frayed out, filled with fungi. Secondarily, through the pressure of the scutulum, there ensue an early flattening of all the prickle cells and almost complete absence of the granular layer. In the sub-papillary cutis layer Unna found dilatation of the vessels, around which the rather firm connective tissue is densely infiltrated with cells. The cellular infiltration attains its highest degree around the funnel of the hair sac and the efferent ducts of the sweat glands; nowhere does it penetrate into the middle layer of the cutis. Besides, he found in several places a cystic degeneration of the hair-follicle containing a spirally twisted hair, and in the efferent ducts of the sweat glands a like degeneration which commences in the cutis, with finely granular as if coagulated contents, probably of inflammatory origin. Strange to say, the sebaceous glands were almost completely absent so that their atrophy appears very probable, while as many as six hairs here and there sprang from one and the same follicle.

Aubert[4] absolutely denies the penetration of fungi into the substance of the hair; on the other hand, owing to nutritive disturbances of the hair, a peculiar dissociation of the hair elements occurs, by which air enters, rendering the affected portions of the hair opaque and black under the microscope with refracted light, while they appear with glossy streaks with reflected light.

The alterations of the skin produced by trichophyton tonsurans are much more vari-

[1] Hebra and Kaposi, "Hautkrankheiten," ii., p. 608.
[2] Arch. f. mikroskop. Anat., iv., p. 300.
[3] Vierteljahrschr. f. Derm. u. Syph., lxxx., p. 170.
[4] Ann. d. Dermat., 1881, p. 43.

able than the favous affection characterized by the formation of scutula, and hence their etiological connection was not recognized until late.

In 1844, Gruby[1] communicated to the Paris Academy of Sciences the finding of fungi in herpes tonsurans. Two years before[2] he had found in mentagra (sycosis) another parasite which he had described under the name of mentagrophyte. At about the same time, Malmsten, of Stockholm, also demonstrated the fungus in herpes tonsurans. Gruby named the fungus which develops in the root of the hair and then penetrates into its interior, in other cases again surrounds the hair like a sheath, rhizophyte, and distinguished it from mentagrophyte. Malmsten termed the fungus of herpes tonsurans, trichophyton tonsurans.

In Germany, v. Bärensprung[3] furnished a very good description of the clinical picture as well as of the fungi of herpes circinatus and tonsurans; but he denies the existence of a parasitic sycosis. In the same way he reports cases of transmission of herpes tonsurans from animals to man, and the reverse. Before that, Fehr and especially Letenneur[4] had reported similar cases of transmission to man of a depilating eruption covered with white scales, occurring in spring on the neck of young cattle, particularly after the winter's stabling, and presenting the picture of herpes circinatus et tonsurans.

Sycosis parasitaria has received a thorough clinical and anatomical description by Köbner,[5] who also clearly demonstrated the trichophyton in pathologically altered nails; Köbner[6] furthermore was the first to furnish the stringent proof that the disease described by Hebra as eczema marginatum is an affection caused by the trichophyton.

One of the most disputed points in the dermatomycoses is the question of the origin of the fungi, some authors maintaining that both achorion and trichophyton and even microsporon furfur are but modifications of one and the same fungus; F. v. Hebra,[7] an adherent to the former view, states that after employing moist compresses and dressing, he had observed the occurrence sometimes of favus, sometimes of herpes tonsurans, sometimes again of both affections at the same time; furthermore, that besides favus, rings of herpes tonsurans appeared on one patient; pityriasis versicolor is to be looked upon as the earliest stage of development of the same fungus. Hallier has also endeavored to support this view by his culture experiments, asserting that from penicillium glaucum he had by cultivation secured sometimes the achorion, sometimes the trichophyton.

In most recent times the unitarian derivation of the three fungi of the skin has received a defender in Grawitz,[8] on the strength of culture experiments. All three showed an exact parallelism in their fructification which is like that of the oidium lactis; all three are morphologically identical both among themselves and with oidium lactis. After subepidermal inoculation with pure cultivated favus, herpes tonsurans, and pityriasis versicolor fungi, as well as with simple oidium lactis,[9] Grawitz witnessed the occur-

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[1] Comptes rendus, 1844.

[2] Comptes rendus, 1842.

[3] Annalen d. Charité, vi., 1855.

[4] "Reflexions sur l'herp. tonsur." Nantes, 1852.

[5] Virchow's Arch., 1861, Bd. xxii.

[6] "Klin. u. experim. Mittheilungen," Erlangen, 1864.

[7] Ztschr. d. k. k. Ges. d. Aerzte, Vienna, 1854.

[8] Virchow's Arch., Bd. lxx.

[9] Experimental inoculations with oidium lactis produced in Prof. Köbner small painful pustules, and no results in myself.

rence of reddening, then small circles of vesicles subsequently showing largely confluent circles, together with itching; in two or three weeks healing ensued by desquamation. He did not succeed in producing favus and pityriasis versicolor.

The advocates of the specific difference of the fungi likewise base their assertions on experimental inoculations. Thus Köbner[1] proved that by inoculations with trichophyton he had never produced anything but trichophytinous affections, at no time favus or pityriasis versicolor. After inoculation with achorion he saw circles of vesicles resembling herpes circinatus which, after a brief existence, either desquamated and perished or else led to the formation of a central scutulum; never did true herpes tonsurans or parasitic sycosis, etc., develop from it. After inoculation with the fungus of pityriasis versicolor only pityriasis versicolor resulted.

Although the various dermatophytes, especially achorion and trichophyton, are not so constituted as regards size, shape, and arrangement as to be microscopically differentiated from each other, still frequently enough the microscopic differential diagnosis can be made by the general appearance of the preparation (predominance of one or other fungus constituent, epithelium, fat, quantity of bacteria, etc.). Even the most complete morphological resemblance of the dermatophytes does not suffice to identify them when they show themselves functionally dissimilar. The forms of the fungi living parasitically on the skin, which consist only of mycelia and conidia, appertain besides to many other fungi living parasitically which, when living as saprophytes or otherwise free in nature, show more highly differentiated forms of fructification and sexual organs. Up to the present time, these forms have not yet been found for the dermatophytes in question.

The source of the infection with fungous affections in many cases is to be sought in like or similar affections of animals. Thus favus is a very frequent disease in mice and rats; from the mice it is transmitted to cats, and from these to men, especially children. Aubert[2] calls attention to the fact that lesions must necessarily be present in order to permit the effectual lodgment of the favus fungus. The more frequent occurrence of minor injuries on the head, as well as the interchange of the head gear during play, are the causes of the greater frequency in boys than in girls. Rare as favus is in Germany, it is incomparably more common in certain districts of France; furthermore, in Scotland (Anderson), in Italy (Dubini), in Denmark (Bergh),[3] where about one-third of favus patients are adults; in the same way, Poland and Galicia are the chief nurseries of favus. In the United States, favus is not rare. Inasmuch as the occurrence of favus is always due to some infection, dirt, lack of cleanliness, defective care of the skin, cohabitation, and living in narrow quarters play only a secondary rôle. In the dust deposited from the air of hospital wards containing favus patients, the conidia of favus could frequently be demonstrated, and thus can be explained the cases in which favus arose after the application of moist compresses changed at long intervals (Hebra), as the moisture and warmth are apt to soften the epidermis deep enough to permit the further development therein of the conidia of achorion present in the wash or the air.

Dermatomycosis trichophytina is in general much more frequent and more uniformly

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[1] "Klin. u. experim. Mittheilungen," Erlangen, 1864.

[2] Ann. d. Dermat., 1881, p. 293.

[3] Bergh, basing on the experience that, in ite of the co on use of the comb and other articles, there is frequently no infection with favus from one affected child to its healthy brothers and sisters, is inclined to assume a special disposition to the development of the mycosis in isolated individuals, which perhaps may be due to some peculiarity of the sudoral (Remak) or sebaceous secretion. ("Beretning fra Almindelig Hosp.," ii. A el. for 1877, p. seq.)

distributed over the various countries. In France, especially in Paris, an exceedingly large number of children are affected with herpes tonsurans; London, too, has no lack of such individuals; and while in Germany trichophytosis corporis is not exactly rare, cases of herpes tonsurans of the head are extremely rare. Perhaps the continual wearing of hoods by little children in Paris allows the fungus, more plentiful there, to take root more easily; perhaps the system in vogue there of gathering somewhat older children into educational institutions as alumni gives occasion for more extensive simultaneous infection with favus. Cazenave (1840) reports a spread of the affection in one educational institution to sixteen children within a short time. Eug. Mahaux [1] reports a like trichophytinous disease extending from year to year in its various forms among the young men levied for military exercises. Not rarely a minor epidemic may be traced to barber shops.

Correspondingly frequent is sycosis parasitaria; in Paris it is of daily occurrence. In Berlin, too, sycosis parasitaria is not very rare. An unexplained fact which has struck many observers, is that trichophytosis, even when quite extensive on the body and beard of adults, spares the hairy scalp.

Herpes tonsurans is a rather frequent disease in animals (horses, dogs, cats, and calves). According to Megnin,[2] teigne tondante in horses is characterized by the cutaneous surfaces being covered with overlapping crusts which consist of small epithelial scales; the hairs are broken off, projecting barely 1–2 mm. above the skin; the spores are light brownish. In calves the affected portions are quite smooth, the hairs not broken, but fallen out in toto: the fungus proliferates both in the follicle and in the adjoining layers of epidermis, not in the hairs. The falling of the hair, as well as the detachment of whole layers of epidermis, give to the herpetic surface an ulcerated appearance. The fungi have yellowish conidia of 5 to 6 micromill. diameter; the conidia of herpes tonsurans in horses are about 2 to 3 micromill. in size. Gerlier[3] makes a distinction between trichophytosis of horses and that of cattle; the former is often epidemic, very contagious, and stubbornly resists treatment; the latter is not so readily transmissible, more easily curable, has even considerable tendency to spontaneous recovery, it most readily extends to the herders, and the trichophytosis of man derived from it is endemic in cattle-raising districts.

The most frequent, particularly in Northern Germany, and most international of the dermatomycoses is pityriasis versicolor. The cause of this is obscure, especially because it is not easily transmissible; perhaps the small amount of inconvenience to which it gives rise, and the consequent slight interest taken by the patients as regards treatment, account for this, at least in part.

The examination for fungi is made by scraping away with a knife enough epidermal scales; sometimes only the deeper layers contain the fungus sought. The removed masses are placed on a slide and twenty to forty per cent potash or soda lye added. The covering glass having been placed over it, the preparation is brought under the microscope with a power of four hundred diameters or more. After the lye has been added, it is not desirable to wait too long with the examination, as when the thin scales are acted on for a great length of time, the clarification of the fungous elements becomes excessive, rendering their outlines indistinct. In the same way should be examined epilated hairs and their stumps which, after prolonged (one to twenty-four hours) maceration in lye and subsequent teasing into the finest fibrils, furnish the most beautiful preparations.

[1] "Recherches sur le trichophyton." Bruxelles-Paris, Delahaye. Thèse, 1869.

[2] Ann. de Dermat., 1880, p. 102

[3] Lyon médical, 1881, No. 18.

Glycerin clarifies the specimens too much, but strong acetic acid, used like the lye, can be employed to advantage. When the epithelial scales are very full of fat droplets, some ether and alcohol are added to them while dry, allowed to evaporate, and then either potash lye or, after treatment with acetate of potassium and rinsing in water, some anilin color (as for instance methyl violet, methyl anilin) to stain the fungi ; but I rarely succeeded in obtaining very good and at the same time uniformly stained preparations.

## FAVUS. DERMATOMYCOSIS ACHORINA.

Favus is characterized by various-sized (from a pin-head to a penny or larger), roundish, sulphur yellow, dry, friable plates. These scutula, so called, have a cup-like depression on their surface, and besides show in their centre a pointed excavation which usually corresponds to the emergence of a hair ; their lower surface is irregularly uneven, convex, and corresponding to the irregular elevations and depressions of the rete in which they are imbedded. They are distinguished by a peculiar mouldy smell which is often compared with the odor of mouse dirt. The affection preferably attacks the hairy scalp, especially of younger persons, but other parts are not exempt. Its duration is usually very prolonged and relapses are frequent.

Favus begins with reddish spots of round form and various size. These have at their periphery a circle of vesicles[1] not always clearly defined (herpetic premonitory stage, Köbner) ; soon a moderate branny desquamation ensues in their centre. Usually after from two or three weeks we see around the hair an exceedingly small, yellow, cupped crust sunk into the skin—a typical miniature scutulum. The favus cup now grows uniformly in a peripheral direction so as to form a larger plate, becoming at the same time more superficial and projecting above the skin. This form, in which the single scutulum remains clearly apart and isolated, is called favus orbicularis s. isolatus, lupinosus. This is the usual manifestation of favus on the trunk or the extremities ; when recent, it is not rare even on the hairy scalp.

By the simultaneous development of the same process on several points in the neighborhood, it finally comes to pass that the single scutula touch at their margins and eventually coalesce. This form is called favus squarrosus. Here, too, after a longer existence the scutula lose the sulphur yellow color and cup-like depression peculiar to the isolated plates. The crusts become paler, to a dirty grayish-white, very dry, wrinkled and friable, and accumulate in irregular, more or less elevated eminences. Through slight mechanical interference such as scratching, whole pieces of the dry crusts fall, together with the hairs inserted in them. The epidermis thus exposed, at first reddened and somewhat tumefied in appearance, at times also slightly moist, soon becomes smooth, here and there depressed, looking like an atrophic cicatrix, of a dull-gray color.

With the development of the scutula the hairs, around which the cups mostly form, are also drawn into the pale of the pathological process. The hair is nearly always perfectly preserved, apparently normal in shape, but it splits very easily and is readily pulled out ; it is of a dull, gray, dry, coarse aspect, and sometimes of a reddish color.

T. Simon[2] reports a case of atrophy of the skull, particularly in the neighborhood of the tubera

[1] St. Cyr (Ann. d. Dermat., I., p. 282) thus describes an accidental transmission of favus to his own hand : On a spot the size of a silver five-franc piece the epidermis is discolored yellowish, thickened, wrinkled, fissured ; at the edge of this spot is a circle of the prettiest vesicles filled with clear serum, barely the size of a lentil or pea ; on close examination one sees around the lanugo hairs yellowish, pin-head sized scutula, cupped in the centre as if pricked with a needle.

[2] Arch. f. Dermat., 1870, p. 541.

parietalia, after favus. Piffard claims to have observed defective intelligence in consequence of favus.

Fig. 41.—Favus of the body with herpetic rings, after McCall Anderson.

Thus, if left to itself, the formation of favi, after the old favus mass has fallen off, may continue for many years until the process finally terminates spontaneously. The affected parts of the scalp are then completely and irretrievably bald, much thinned and sunken, dry, of a dull lustre, smooth, but slightly desquamating in places; usually there is some indication of superficial longitudinal and transverse furrows dividing the skin into large irregular fields.

Not rarely, while the scutula are at their height, we see superadded on the scalp, by scratching or other interference, secondary, eczematous and furunculous processes; in such cases, owing to absorption of pus, there is nearly always some swelling of the cervical lymphatic glands which sometimes suppurate.

On parts of the skin supplied only with lanugo, typical scutula can be seen in special perfection, having a diameter of about 1.5 cm., but even here larger confluent crusts are not lacking. Generally their existence is very brief, the scutula soon drop off, while no new ones are formed; the disease terminates usually without cicatrization, but for some time an abnormal pigmentation (brownish yellow to brownish) remains.

The proliferating achorion does not spare the nails, but generally only a few are affected. In some cases the characteristic yellowish crusts (scutula) show themselves at the free edge of the nail, in others at the more central portions, and still more frequently the alteration of the nail perfectly resembles that occurring in herpes tonsurans; the nail becomes turbid, intersected with longitudinal and transverse furrows, thickened in some places and thinned in others. Onychomycosis, if left to itself, is very intractable.

Anatomy.—On sections we see, usually on the upper and under surface of a scutulum, a sort of covering of epidermis cells; the mass itself consists of an enormous quantity of threads and conidia, besides masses of zoogloea, rod-shaped and spherical bacteria, epidermis cells, and pus corpuscles. The size of the spores is very variable, up to seven micromill. to eight micromill.; generally they are round or oval, others are more drawn out and constricted in the centre, another part is still more angular, and we meet also with rosary-like chains of conidia; usually they contain a large peculiar, yellowish lustrous nucleus, others have a yeast-like appearance. The mycelium consists chiefly of somewhat serpentine threads divided into unequal segments, of variable width,

and with numerous lateral sprouts having sometimes bright, homogeneous, sometimes granular, turbid contents; the broader threads contain more or less numerous, different sized nuclei with nuclear corpuscles, or taper into a chain of conidia. Here and there we find bundles of fibres joined by anastomoses, the connection of which is easily loosened by traction or pressure, so that they readily separate into isolated segments or conidia.

According to Balzer,[1] the achorion develops between the rete at the mouth of the hair-follicle; the superficial layers of the epidermis are firmly adherent to the hair, and during the growth of the fungus are prevented from rising, and thus is brought about the cupped form (godet) of the favus plates. (This formation of cups occurs also in the proliferations of oidium albicans in the intestinal tract.—Parrot.) It is only in the further course that the hair is directly or indirectly affected from the root sheath; moreover, the achorion penetrates through the inner and later through the outer root sheath even into the subcutaneous tissue, reactive inflammations being the causes of the subsequent scar formation. Not all the hairs in a favous district are attacked by the fungous proliferations.

In favus inoculated on my own arm, I saw on hair pulled as early as the second day conidia lie on the cuticle of the hair at a short distance from the root; on the fifth day there were on the cuticula numerous delicate, long threads, as well as a dense network of fungus fibres around and in the root of the hair; at a short distance from it, one hair showed a club-like expansion at one point.

The DIAGNOSIS cannot be made with equal facility in every stage. In the herpetic stage it is hardly to be distinguished from herpes tonsurans, but this uncertainty lasts but a short time, as a small scutulum soon forms around a hair in favus, while in trichophytosis the spots, covered with scales in the centre and having more or less distinct vesicles at the periphery, soon spread farther in the same form, and besides, the hairs on hirsute parts are changed to a great extent into small shapeless stumps. When the scutula are discrete on the scalp, they may be confounded with 1. impetigo: here the crusts are more of a grayish yellow color, have a fatty feel, are not cupped in the centre, but convex on their surface; when removed, there is disclosed either a moist or slightly bleeding corium; frequently the hairs are glued here and there into small bunches by preceding serous exudation: 2. with acne varioliformis (Hebra); this has more yellowish brown or brownish crusts fitted into a depression in the skin; after their removal they leave a permanent pockmark-like depression, and the disease belongs more to middle life. When the scutula of favus are united into a larger connected crust we must differentiate it from 1. rather extensive impetiginous eczema; here the crusts are more greasy and are not easily rubbed into a pulverulent mass, the odor is more cheese-like and rancid, under the crusts a watery fluid usually exudes, the hairs are intact, only glued together. 2. Psoriasis has flaky whitish masses of scales, the skin beneath is reddened, smooth, slightly bleeding. 3. Beneath seborrhœic fatty scales the skin is mostly of a normal color, smooth. In all doubtful cases, the microscopic examination of the favus masses furnishes the most positive information.

TREATMENT.—For the removal of the superficial masses of fungus we resort to emollient applications, warm poultices, washing with lukewarm soapsuds, etc. Cure is thus obtained in the shortest time, but only apparently, for fresh growths of fungi soon spring up again from within the hair-follicles, and then it becomes necessary to cause

[1] Arch. génér. d. Médec., Oct., 1881.

the casting off of those layers of epidermis in which the fungus has its seat. Bazin first elevated epilation, with simultaneous application of corrosive sublimate washes, to the dignity of a therapeutic method; for this purpose he employed tweezers and in a few days complely epilated the affected parts of the head, together with a larger, apparently still healthy marginal portion. The epilation was followed by washing with a one-half-per-cent solution of corrosive sublimate containing some alcohol; in other cases Bazin also used frictions with tar, or an ointment of crude carbonate of sodium and quicklime, of each two parts, to lard sixty parts; or rubbing with ointments containing mercury, especially turpeth mineral one part, to lard thirty parts. These ointments are rubbed in morning and evening; if the cutaneous irritation becomes too violent, application is made for some time of cataplasms of oil or of potato-meal. After about three or four weeks epilation is recommenced, and repeated at longer or shorter intervals, with subsequent use of the ointment until the cure is complete. At first the epilation is painful, but becomes less so with every succeeding procedure. In place of the sublimate or the painting with tar, we may also choose *ad libitum* among the disinfectant coal-tar derivatives which at the same time excite some slight inflammatory action of the skin, such as benzol, phenol, thymol, creasote, naphthol, salicyl, etc. Parasiticides are then only of value when they have at the same time an irritating action on the skin and thus hasten the casting off of the upper layers; of late, chrysarobin and pyrogallic acid have been superadded to the large number of agents named above. Croton oil induces too violent pustular inflammation of the skin to permit of its use. To rub in pure carbolic acid can hardly be recommended, owing to the symptoms of toxic absorption to which it may give rise, and to its great painfulness. The disease can be declared cured only after several repeated tests: after a variable length of treatment (mostly five to six months and more), the hairs are permitted to grow without any therapeutic interference, and from time to time during about six weeks the hair and scalp are carefully examined, in doubtful cases even with the microscope. If during this time there are formed neither scutula nor any red round scaly spots (herpetic stage), the treatment, or the danger of infection, is at an end.

Favus of the rest of the body is more rapidly and more easily cured than favus of the scalp. The scutula find little support in the efferent ducts for the lanugo hairs, emollient applications soon cause them to drop off, and the subsequent employment of frictions with tar, etc., prevent the re-formation of the fungus.

In favous onychomycosis, the most rapid and complete removal of the nail substance by mechanical or chemical means is the most appropriate practice. Either the nail is carefully filed or scraped off, or the corneous lamellæ are softened by repeated application of concentrated potash solution or protracted soap, soda, or potash finger baths, until healthy nail substance grows forward from the matrix. The effect of the so-called parasiticide ointments and solutions, if used alone, is generally but short-lived.

## DERMATOMYCOSIS TRICHOPHYTINA.

*Herpes circinatus and tonsurans, Sycosis parasitaria, Eczema marginatum, Kerion Celsi. Ringworm.*

In accordance with its location and duration, the clinical picture of dermatomycosis trichophytina assumes a special type. On the body, on parts where there are only lanugo hairs, it begins as a small red spot, somewhat scaly in the centre, barely elevated, often

bearing extraordinary resemblance to squamous eczema ; the border is not always quite round, and soon enlarges into a wider circle. This circle has quite a characteristic appearance; at its periphery it is composed of a series of the smallest vesicles, each surrounded by a delicate red areola; toward the centre the branny scales give to the skin a more dirty gray color. In some cases the vesicles form a partly imperfect ring, there being lacunæ in the latter by defective development, or there are merely curved rows of vesicles.

In other cases again, the vesicle formation is only indicated, constituting merely an insignificant, not translucent elevation of the epidermis. At times, there is no indication of vesicles, so that the differentiation from eczema squamosum is possible only by the microscope or by characteristic neighboring efflorescences. On the other hand, there occur here and there large uniform elevations of the corneous layer of the epidermis, the size of a five-cent nickel, beneath which a small quantity of sero-purulent fluid accumulates, that is, a formation of bullæ; this soon dries into a thin crust which looks as if glued on (one form of impetigo contagiosa, Tilbury Fox). Cases of this kind are not so rare as might perhaps appear. From the central bullæ the affection often extends as typical herpes circinatus; the bulla formation is observed chiefly in the face of children.

The vesicular contents, at first bright, later somewhat yellowish, persist in all cases only a very short time, often but a few hours; they evaporate or dry up, the cover of the vesicle being very thin and the contents very small in amount.

When in the course of days or a few weeks the circle—at first from the size of a five-cent nickel up to that of a quarter dollar—spreads farther, while a number of circles or larger rings form either from multiple infection from the beginning or by auto-infection, there will finally be here and there a contact of adjoining rings. In this case there ensues at the point of contact of such curves a disappearance of the vesicles and obliteration of the sharp demarcation, and a uniform desquamating surface results. Where two or more such circles unite, the limits form peculiar festooned figures.

By the side of these circles bordered by vesicles (herpes circinatus, ringworm), we also frequently see round or oval, more or less elevated patches with steep margins. They are covered with a moderate quantity of dirty gray scales, projecting like spines, often of a very brawny feel; at times their centre is somewhat depressed, discolored light-brownish or yellowish, hardly desquamating at all. A peripheral red areola cannot always be demonstrated. Their size is very variable, just like the other form. Hebra distinguished it as herpes tonsurans squamosus. Isolated small patches, ranging in size from that of a five-cent nickel down to that of a three-cent piece, are covered with a coherent, silvery, thin scale; peripherally they are limited by a distinct, slightly elevated, red, variably wide border which gradually merges into the normal color of the skin.

Some of the rarest cases are those in which two concentric circles of vesicles are present, and recently Unna[1] has figured a case in which three concentric rings could be observed. I am indebted to Dr. Lesser, of Leipzig, for the photograph of a case with three concentric rings of vesicles. Only the forearms were affected. The affection had existed but a few weeks. Under the microscope Dr. Lesser found an extraordinary number of fungi, trichophyton Malmsten.

The fungous affection called by P. Manson[2] tinea imbricata is a variety of herpes

[1] Vierteljahrsschr. f. Dermat., 1880, Heft 2 and 3, p. 165.

[2] McCall Anderson, Edinb. Med. Journ , 1880, p. 205, after Chinese Imperial Customs Gazette, 1879.

tonsurans. According to this author, this tinea is distinguished from herpes tonsurans endemic in Europe in almost every particular; the epidermis is thrown up in large flakes in concentric parallel wavy lines, similar to the sand dunes terraced by the tide.

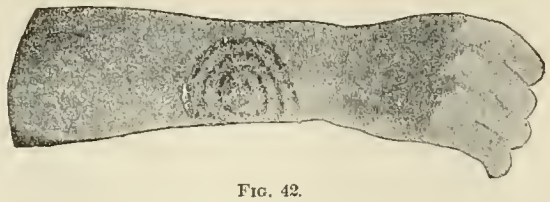

FIG. 42.

In Wilson's *Journal of Cutaneous Medicine*, iv., p. 251, we find the following notice by Turner on Tokelau (Samoa) ringworm: it resembles ichthyosis more than any other disease. The scales, however, differ from it mainly by the fact that they are arranged in squares as well as in concentric rings, and we can represent their form by lifting the uppermost layers of a hard cardboard by means of a knife so as to cause them to curl up. The detached flakes of epidermis often exceed one-quarter inch in size.

The conidia at the same time are exceedingly numerous, lie only in the most superficial layers of the epidermis, are oval or square, irregularly spherical, in separate groups or dichotomously branching twigs, at times dark in color, and often contain reddish-brown granules. Mycelium pale or darkly granular, generally long, straight or curved, dichtomously branching, partly separated by intervals, small lateral protuberances, numerously jointed. The threads end either in bulbs or in chains of conidia. The disease affects mainly parts having little hair.

Inoculation always produces tinea imbricata. After about nine days there ensues an elevation of the epidermis with formation of brown masses between corium and epidermis; the detached epidermis is still partly connected at its margins with the skin. Rubbing causes the scales to fall and the pale corium becomes visible. Meantime there is formed in the centre a new brown spot which undergoes the alterations before described, and thus, while the affection extends peripherally in circles, new concentric circles form continually in the centre. Tinea imbricata may spread over the whole body..

When the trichophyton has taken root on hirsute parts such as the scalp, it rarely, and then only in the beginning, presents the appearance of herpes circinatus. Usually there is formed a slightly reddenened, desquamating spot, on which the color and shape of the hair soon undergo changes. The hair becomes dry, dull, loses its normal glossy color, breaks under gentle touch, dark hair becomes lighter. When we try to pull a diseased hair, either a large part of its lower end remains behind, or, when the affection is more recent, we obtain a hair with a thickened grayish white root sheath. The small discolored hair stumps are seized with difficulty and hard to remove, and are surrounded by grayish white sheath of scales in which the fungus is as plentiful as in the hair. The morbid process spreads continually; the scalp is thickly covered with dull gray scales beneath which more or less vivid redness is visible (herpes tonsurans). Usually the outlines of such a spot are very irregular and ill defined, alongside there are frequently small surfaces covered with fine scales resembling simple psoriasis, in which only the most careful attention can here and there discover a shapeless hair-stump enveloped in scales. Only rarely the swelling of the skin assumes greater dimensions; there may be pustular, eczematoid eruptions. In isolated cases proliferating inflammatory processes

have been observed; such rare cases have been described as kerion Celsi. The borders of the hairless patches are round only in the beginning, later they are of different sizes and in variable numbers and generally are marked by irregular diffused margins.

In some cases, the depilated patches become absolutely bald, the skin as smooth as ivory and glossy so that they may be taken for patches of area Celsi. Only at times is it possible to discover in the environs of such an area hair-stumps and heaps of scales which permit the diagnosis. Such cases may well have given rise to the assumption of the simultaneous occurrence of herpes tonsurans and area Celsi, as well as to the assertion that there is an infectious area.

Trichophytosis of the body as well as the scalp causes in most cases more or less intense itching; it is never associated with febrile symptoms.

In the beard, trichophytosis genenerally presents the same phenomena as on the hairy scalp, and these more or less superficial alterations, even when of rather long standing, occur in the fine, light, thin beard hair. In dark, coarse, dense, frequently shaved beard hair, and from causes still unknown, more violent and deeper inflammatory processes are not rare. We then see, on a surface at first generally round, the several follicles become elevated in the shape of small red papules soon exhibiting purulent contents in the centre, or else the skin early becomes thickened, reddened, nodular, around the hairs distinct pustules form which soon loosen the hair; if we remove the loosened hairs with their purulent sheath, a copious watery, light yellow, gluey fluid exudes from many pores as from a sieve; this fluid dries almost at once and forms crusts (sycosis parasitaria). The originally very limited process soon extends with deep phlegmonous infiltration into the surroundings. The skin acquires a deep red color, has a doughy feel, the hairs are the centre of a pustule; considerable pain is present and a feeling of great tension in the skin. At times larger isolated subcutaneous abscesses are present in the infiltrated, little resistant tissue. Incisions in the skin cause enormous capillary hemorrhages. Swelling of the submaxillary or upper cervical glands is rarely absent. In isolated cases febrile conditions are present.

Not rarely the surface of the infiltrated parts of the skin covered with thick crusts becomes uneven, nodular, verrucose, there appear mulberry-like, acinous, papillomatous proliferations between which pustulation occurs.

Where the affection has run its course with considerable abscess formation, we must expect healing with cicatrization. In most cases, when properly treated, restitution ad integrum follows.

The disease described by Hebra in its more intense stages as eczema marginatum, and by Bärensprung in its lighter forms as herpes inguium, likewise begins usually as a typical trichophytosis and by preference in the pudendal and inguinal regions, particularly where the scrotum touches the thigh. A picture resembling eczema marginatum is at times also produced on the neck by the trichophyton.

Slowly the originally small circle, healing in the centre with brownish discoloration, extends in all or in only one direction, so that there results either a very large circle or, what is more frequent, a brownish discolored large surface limited by curved lines. The affection spreads from its original site, on the one hand forward and upward from the pudendal and internal inguinal region to the abdominal wall, and on the other across the perineum to the anal and gluteal region. The margin of the affected parts is raised like a wall, at times small vesicles are still visible, but the majority of these is soon destroyed by the more plentiful sudoral secretion on these parts of the body and the coincident greater maceration of the epidermis. Besides, as

the disease is usually observed only after it has existed for some time, considerable alterations have been produced by the scratching finger. As a rule the itching is so violent that the effects of the scratching give rise to a picture very similar to eczema: a number of weeping spots by the side of brown bleeding crusts, together with very great thickening of the skin, especially at the periphery as in chronic infiltrated eczemata: besides the formation of furuncles. The hairs in this region are generally intact, some are torn off

Fig. 18.—Sycosis parasitaria, after Köbner, from Virchow's *Archiv*, Bd. XXII.

by the scratching finger. A further peculiarity is the great relapsing tendency of the affection.

In tropical countries[1] the affection is very frequent, and this is ascribed to lack of cleanliness. Men are particularly attacked by it. Köbner[2] succeeded in demonstrating by experimental inoculations the etiology of the affection, so that no doubt

[1] Nicholson, "Burmese Ringworm." Wilson's Journ. of Cutan. Med., i., p. 377.

[2] "Klinische Mittheilungen," Erlangen, 1864, p. 6.

remains in the minds of unbiased observers; it is solely the peculiar seat of the affection which causes the singular course, and not, as Hebra[1] maintains, "that the maceration of the epidermis and irritation of the corium must be fulfilled as the first condition in the development of eczema marginatum, and that then, on the favorable territory thus prepared, the further development of the fungous elements, which have reached the skin from without, takes place."

The nails are not exempt from the invasion of the trichophyton, although onychomycosis trichophytina, as compared with the frequency[2] of the other cutaneous affections due to the same fungus, is rather rare. Mahon first observed the concurrence of herpes tonsurans of the head with disease of the nails. The toe nails are far more often attacked than the finger nails.

The nails become considerably thicker; their surface becomes rough, uneven, and split; irregular longitudinal and transverse streaks are plainly visible. At other places, whole pieces of the nail substance are sprung off, and only a larger or smaller remnant of the nail is present at the matrix. The thickening and friability affects by preference the free edge of the nail, and here we often see the several layers of the nail substance folded apart like the leaves of a half-open book; at times the nail is more or less inclined toward the finger tip (a slight degree of onychogryphosis). At the same time the nail loses its natural lustre, becomes dull, pale yellowish, with irregularly scattered, small grayish white spots. Here and there dirt accumulates, especially at torn portions of the nail. The alteration does not always attack the nail over its entire length, and not all the nails of the same extremity.

If we examine the splinters of the nail under the microscope after prolonged maceration in potash lye, we find mycelia generally more plentiful than conidia.

Although the whole nail is often degenerated, still at times spontaneous recovery ensues after detachment of the diseased nail.

The diagnosis can generally be determined only by the aid of the microscope.

Dubini (1865) has described under the name of vespajo del capillitio an affection of the hairy scalp which closely resembles sycosis parasitaria and has almost the character of a furunculous or plegmonous dermatitis, but which he did not believe to be parasitical. Similar cases have been described by Wilson[3] as kerion Celsi (honeycomb), who thought the disease to be a phytiform (!) degeneration of the skin; it was T. Fox who first included it in the series of affections produced by trichophyton; so did Tanturri[4] and Auspitz. According to Tanturri, the disease begins with red, round or oval plates covered with fine scales (herpes circinatus) which are but slightly elevated above the skin. Soon these places become very prominent, vivid red; from innumerable small points corresponding to the efferent ducts of the hair follicles there exudes a tenacious or less viscid cohesive yellowish fluid and pus; here the hairs can easily be removed. When the disease is recovered from, permanent alopecia and pale discoloration of the skin remain on the most intensely affected places. It is not always easy to find the fungi. When less grave, the disease in its external form corresponds more with small furuncles or closely resembles small patches of impetiginous eczema.

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[1] "Lehrb.," 2te Aufl., Bd. i., p. 492.

[2] Köbner, Virch. Arch., Bd. xxii., among several hundred cases of herpes tonsurans saw only two of nail disease.

[3] "Skin Diseases," 1867.

[4] Morgagni, 1871, p. 130.

Forlanini[1] expresses himself against the causal connection of kerion Celsi with trichophyton. He asserts that kerion may pass through all its stages without the presence of the fungus; also that the rapid recovery speaks against the parasitical nature. The process begins between the cuticula of the hair and the internal root sheath with exudation as vesicles, later the hair is altogether lifted and separated from its root, as the hair bulb is implicated. In the further course, subcutaneous abscesses arise through the implication of the adjoining epidermis and the corium. Herein were found giant-cells, only exceptionally fungi; nor were the latter present in the pus, the contents of the vesicles, the crusts, the scales, and the hair itself. Experimental inoculations were without effect. In but a single excised piece of skin one solitary hair was found with trichophyton.

Anatomy.—In herpes circinatus the trichophyton is seated in the upper and lower horny cell layers, rarely in the rete; thence it penetrates along the hair between it and the internal root sheath in the hair follicle, the fungus forces the cuticula apart and crowds into the hair shaft, thereby only the outlines of the hair becomes clearly visible, while its substance is destroyed by the penetrating, longitudinally extending mycelium. The fungi do not force themselves in deeper than the upper end of the hair bulb; the hair papilla, the connective-tissue wall of the hair follicle, the subcutaneous connective tissue are not attacked, and the external and the internal root sheaths are entirely intact. There are no symptoms of inflammation in the skin (Taylor), while Thin finds the cutis and rete in an inflammatory condition. Robinson[2] finds the upper part of the external root sheath of the hair plentifully, the corium and the subcutaneous tissue only sparsely set with spores, a few spores are around the root of the hair and within it.

According to Balzer,[3] the fungus is seated at first on the normal cuticula, then the hair sheath and root are penetrated by threads (mycelia) containing conidia, and thence the fungus extends into the hair, when the spore-bearing mycelia disintegrate into segments. Subsequently the whole hair, excepting the medulla, is filled with conidia, and finally is destroyed by them, the cuticula disappearing.

The forms presented by the trichophyton are very manifold. In the scales of the red patches on hairless parts the mycelia are more plentiful than the conidia. The former are simple or anastomosing threads with small lateral sprouts; their length is very variable as is their width; the narrowest exhibit septa only at very long intervals, the broader are divided at more or less short intervals, and in each septum there are one or more different-sized pale or glossy nuclei with nuclear corpuscles; many of the mycelia, besides, look as if sprinkled with fatty granules. The conidia are variable in size and shape: round or flattened, with doubly contoured membrane, pale sparse protoplasm, often a very large nucleus with yellowish lustre in which one or more nuclear corpuscles can be discovered only with difficulty and not always. The hair-stumps, the surface of which is covered with innumerable, generally irregularly arranged conidia, are comparable to the favus scutulum as regards the number of fungi. Within the hair are mycelia and rows of conidia running parallel to the longitudinal direction of the hair. The mycelia here are extraordinarily clear and possess an indescribable variety of forms. But nowhere was I enabled to see what Kaposi describes, namely: "that the threads are composed of long dumb-bell shaped cells, between each two of which a small round body is inserted which in some threads is organically united with the long cells, in others only loosely

[1] Annal. de Dermat., 1880, abstract from the Italian special journal.
[2] Arch. of Dermat., viii., p. 406.
[3] Arch. génér. de Méd., 1881, p. 407.

adjoins them, or alternating with the former, aids in representing only a disconnected chain of elements." By the penetration of the fungi, the square corneous flakes of which the hair is composed are overgrown from all sides and loosened.

Diagnosis.—Although herpes circinatus, tonsurans, sycosis parasitaria, kerion Celsi are only various stages of the same process, it is desirable to keep them apart so as to facilitate the survey of the differential diagnosis. Herpes circinatus is liable to be confounded with: 1. Pityriasis rosea (Gibert); the latter lacks the circle of vesicles, its peripheral extension is very rapid, with equally rapid spontaneous recovery in the centre with light yellowish discoloration of the skin; no loss of hair, no fungi, short duration of the affection; 2. With psoriasis; the latter is distinguished by plentiful white layers of scales on a reddened basis, the patches are inclined to take on a symmetrical arrangement; 3. With circinate syphilide; in this the centre is completely normal or darkly pigmented, sunken, atrophic; the peripheral infiltration has a brownish red color, is firm, generally scaleless or covered with smooth thin scales, without itching; 4. With orbicular eczema; this occurs chiefly in scrofulous children, has no tendency to spread peripherally, never shows any formation of vesicles, has larger lamellar scales, attacks by preference the hands and face, often symmetrically.

Herpes tonsurans, when circumscribed, is easily distinguished from pityriasis simplex, eczema squamosum, by the discoloration, dryness, and fragility of the hairs, the presence of small misshapen hair-stumps; it appears generally in circumscribed plates. When more diffuse, and associated with secondary crust formation, the distinction is more difficult; but even here there is no lack of broken and, in the case of dark hair, discolored hairs and others surrounded with white small sheaths of scales. In persons whose hair is cropped very short, the diagnosis can often be made only with the aid of the microscope. Area Celsi leaves the skin smooth as ivory and glossy, only here and there are very thin, slightly colored small hairs clubbed at the ends.

Sycosis parasitaria and kerion Celsi in their slighter degrees can easily be confounded with idiopathic sycosis, but the former sets in with round, red, more or less flaking spots, with or without a circle of vesicles, as well as in places resembling pityriasis alba with the characteristic hair-stumps; after a brief existence, rapidly spreading into the healthy surroundings, it produces deep, soft, phlegmonoid infiltrations with pustulation around the hairs; it forms spongy cutaneous nodules provided with openings (corresponding to the lost hairs) the secretion from which is very profuse; while idiopathic sycosis, in its slow progress, deposits smooth, often very hard infiltrations; at times the infiltration is but very slight and there is hardly anything except pustulation around the hairs; there is an absence of the red, circumscribed, desquamating spots. In some cases, the nodules of sycosis parasitaria, by their deep color, bear some resemblance to tuberculo-ulcerous syphilide; but in such cases the usually rapid springing up of multiple sycosis tubercles, their soft, almost fluctuating consistence, their quick pustulation around the hairs obviate any mistake. Lymphadenia cutanea (mycosis fungoides) rarely occurs in the face alone, and is distinguished from parasitic sycosis existing only on hirsute regions by multiple tubercle formation on the whole body; besides the former forms more smooth, slightly scaling or serum-discharging tubercles, while in the latter, irregularly tuberous proliferations and pustulation around the hairs are rarely absent.

Eczema marginatum is distinguished from ordinary eczema by its curved outlines; besides, around the large eczematous surface there are frequently larger or smaller moist, pustular, or squamous places. Furthermore, in the latter both the superficial alterations (desquamation, reddening, weeping, fissures, etc.) and the great infiltration of the sub-

cutaneous connective tissue are generally developed in equal intensity; while in eczema marginatum there is comparatively little desquamation, pale to brownish color with great thickening of the skin; besides, fresh trichophytinous rings arise on previously healed, discolored portions. Eczema of the genital region attacks by preference the whole scrotum primarily and from there the other parts, while in eczema marginatum mainly the thighs and only the lateral parts of the scrotum form the first site of the affection. Eczema marginatum often resembles squamous infiltrated chronic eczema in every particular in its external appearance, so that only the etiological factors determine the difference.

Treatment.—Herpes circinatus often needs nothing but energetic washing with soap, or several repeated paintings with tar, chrysarobin, or pyrogallic acid ointments, or one of the ointments or solutions enumerated under psoriasis or favus; even painting with ink (sulphate of iron) has at times acted very favorably.

In the treatment of herpes tonsurans we must not count on a cure in a short time. Even in the most favorable case, the treatment consumes months, as well as a subsequent stage of several months after apparent recovery, as a single diseased hair may effect the reinfection of the entire scalp. All the hairs on a diseased spot without exception are removed by epilation, and it is advantageous to extend the epilation even to the hairs at some distance. According to Bazin, epilation should be preceded by painting the skin with oil of cade so as to reduce the pain of the operation. The diseased hairs often break off, leaving the stump closely packed with fungi, hence the epilation must be often repeated. After the epilation, performed in different sittings, the diseased patches are painted or rubbed with solution of corrosive sublimate, tar, chloroform, chloral hydrate, pyrogallic acid (5 to 10 per cent), chrysarobin ointments, etc. To cause the hairs to be cast off by suppuration by means of the application of croton oil, I hold to be an unsuitable procedure. Not until the hair can be readily withdrawn without breaking, when the skin has acquired a smooth pale appearance, may we permit the hair to grow unhindered.

The same treatment is applicable to parasitic sycosis and kerion Celsi, viz.: epilation and the employment of the above-named solutions and ointments; where there are very violent phlegmonoid inflammatory symptoms, emollient cataplasms are indicated; besides Zeissl's sulphur paste may be used with good result where the cutaneous infiltration is extensive; when subcutaneous abscesses exist they must be incised. While parasitic sycosis exists, it is to be recommended not to permit shaving, by which the fungus might easily be transferred into healthy follicles.

For eczema marginatum Hebra recommends Wilkinson's ointment, which is to be rubbed for six days, morning and evening, into the diseased spots, after which they are bandaged with flannel. Not before eight or ten days after cessation of the treatment is bathing or washing of the parts permitted. Wilkinson's ointment makes the skin very brittle, so that it is easily broken, and therefore its application is often very painful. The method of treatment given for herpes circinatus and tonsurans is here likewise of use.

The diseased nail substance is removed in the same manner as in favus.

## DERMATOMYCOSIS FURFURACEA. PITYRIASIS VERSICOLOR.

*Pityriasis versicolor* is characterized by brownish spots generally desquamating but slightly in the centre, but easily removed with the finger nail without hemorrhage. The affection is nearly always connected with moderate itching.

The size of the spots is exceedingly variable. Often we see them around a lanugo hair barely the size of a pin's head, slightly if at all elevated above the surface, scattered over the chest, abdomen, and back; in other cases, large portions of the trunk, especially the upper part of the back, are covered with a connected brownish color hardly broken by normal places. Unna[1] reports the occurrence of an acute variety of pityriasis versicolor which heals in the centre and develops into circular and curved forms. The proportionately rarer occurrence of pityriasis versicolor on the neck, face, and hands has its reason probably in the fact that these parts are most frequently and rapidly freed by soap and water of the uppermost epidermis layers in which the fungus has its seat. On the palms and soles it has not hitherto been observed. Aside from the trunk where it is most frequent, the affection is common also in the genital region, in men particularly on those parts of the thigh where the scrotum touches; here the spots often aquire a more brownish red to copper color. In women, it is very frequent in small patches in the pubic region and on the skin of the labia majora. The upper extremity is attacked far more frequently than the lower.

As a rule, adolescents and adults suffer from the affection, old people and children are exempt.

The growth of the spots is exceedingly slow, some medium-sized spots often persisting for years without alteration. At times, in strongly perspiring, obese persons, we observe a more rapid spread of the disease in the hot season. In other cases the affection increases in winter, by reason of the warmer clothing and less frequent bathing.

The contagiousness of the disease is exceedingly slight.

Experimentally, Köbner alone has successfully inoculated pityriasis versicolor on men and rabbits.

So far as known, the hair and nails are exempt from the invasion of the microsporon furfur. The peculiar yellow color of the spots would seem to be due to the yellowish, strongly refractive masses of conidia which are always present in large numbers. In the centre of larger spots, where there is generally a visible sparse branny desquamation, a more smoky gray color prevails. The discoloration has its seat only in the uppermost horny layers, for when this brownish layer is removed by gentle scratching or friction—and it readily comes away in larger or smaller lamellæ—a dull gray colored skin is exposed. This sign is one of the best for differentiating this from all other pathological discolorations of the skin originating in the deeper layers of the rete or in the cutis, and which had been classed with pityriasis versicolor under the name of chloasma.

Anatomy.—The fungus of pityriasis versicolor was first described in 1846 by Eichstedt and named microsporon furfur by Robin. It is very characteristic by the arrangement of the conidia, very plentifully present in the scales and lamellæ. The conidia are generally round, of variable size, usually somewhat smaller than the red blood-corpuscles, have a strongly lustrous, large, round, yellowish nucleus (at times provided with dark granules) which is situated in the centre of the bright transparent protoplasm, the latter being inclosed in a doubly-contoured membrane. The conidia are arranged in nests or conical heaps, closely crowded together. Around them in confused intermixture lie the mycelia, usually pressed close together. The latter are threads of various width and moderate length constricted at long intervals, running in wavy or curved lines but never branching; on slight pressure they disintegrate into single oblong, sometimes curved segments. The latter are clubbed here and there, one of their extremities often

[1] Vierteljahrsschr. f. Dermat. u. Syphil., 1880, Heft 2 u. 3.

appears as a knob-like bright swelling, at times they contain isolated lustrous granules, in other places we see in them rows of oblong-oval nuclei looking like vacuolæ and containing dark nuclear corpuscles; some segments are short and sausage-shaped, others taper to a point at one end, on others we see at various places indentations nearly uniform on both sides. Some threads are rather narrow and filled with dark, larger or smaller granules, while others appear altogether pale and vacant.

*Diagnosis.*—The brownish color, as well as the slight desquamation and ready removability of the uppermost layers with the finger nail, will easily obviate confounding with similar efflorescences on the trunk, such as macular syphilide, pigment remnants after other eruptions, brownish warts, and other more deeply seated pigment anomalies. More difficult, often quite impossible without microscopical examination, is its differentiation in the inguinal and upper femoral region from intertrigo, particularly in male persons who perspire very freely. From extensive patches of lichen acnéique pityriasis versicolor is differentiated by the more brownish than yellowish color, the absence of small nodules and crusts in the periphery of a large patch. Pityriasis rosea rarely reaches in its centre so great a discoloration as to be confounded with pityriasis versicolor; besides, the former is distinguished by the red circular border and the acute course.

Treatment.—In the treatment of pityriasis versicolor, it is essential to cause the more rapid casting off of the uppermost layers in which the microsporon has its seat. In doing so, however, it is not always possible to remove at the same time those fungi seated around the point of exit of the lanugo; this probably is the reason why pityriasis versicolor again spreads even after very energetic therapeutic measures. Frictions with green soap followed by energetic ablutions in the bath, repeated several days in succession, are useful in treatment. Furthermore, frictions with ointments of chrysarobin ten to twenty per cent, pyrogallic acid five to ten per cent, salicylic acid five to ten per cent, thymol five per cent, sodium subsulphate ten to fifteen per cent, etc. Likewise with oil of cade, Wilkinson's ointment, and tincture of iodine.

## ERYTHRASMA

Is the name given by v. Bärensprung[1] to a disease confined to the inguinal and axillary regions; it is contagious, presents the appearance of pityriasis rubra in the form of roundish or rosette shaped, sharply demarcated spots, and which he attributes to the fungus described by Burchardt,[2] the so-called Microsporon minutissimum. Oscar Simon[3] has endeavored to show that the erythrasma is an intermediate step between pityriasis versicolor and herpes tonsurans.

While pityriasis versicolor in the inguinal region is an almost daily occurrence, erythrasma manifests itself more rarely in its pure forms. It represents a large, dry, reddish brown, often copper-colored surface covered with branny scales; its margin often surrounds the detached epidermis in a circle. Beside it are frequently several similar or more orange colored or pale reddish yellow spots with irregular outlines, barely the size of a five-cent nickel. The scales can be removed only in the shape of a fine flour. In them we find rather short, narrow (not half the width of those in pityriasis versicolor), very pale, slightly curved, or stiff and very long threads at times composed of two or three segments.

[1] Ann. d. Charit., 1862, Bd. x.

[2] Med. Zeit. d. Vereins f. Heilk. f. Preussen, 1859, No. 29.

[3] "Localisation der Hautkrankheiten."

In other rare cases, some of the larger threads consist of rosary-like, closely adjoining, flattened small segments, the segmentation of which becomes visible only on very attentive inspection. The greatest transverse diameter is barely 0.6 micromill., in most cases they are narrower. Their length is exceedingly variable. We also find, by the side of long threads, others twisted in wave lines, of different lengths, but always very narrow and pale. Where the network is most dense and confused, the threads are the smallest. Lateral branching of the filaments is nowhere to be seen, any more than the formation of conidia. In their reproduction they seem to stand nearest to the schizomycetes. Some long threads are distinguished by a strong lustre at their end which is at times curved into a hook. The scales contain besides a number of small bacteria and heaps of zoogloea.

Burchardt has described the fungi in chloasma as follows: The threads are neither straight nor curved, their breadth is $\frac{1}{1200}$ mm., the length is very variable, the longest $\frac{1}{25}$ to $\frac{1}{15}$ mm.; but most of them are much shorter, $\frac{1}{200}$ mm. and less, so that they form the transition to the granules, the diameter of which equals the breadth of the threads. The threads are neither branching nor segmented. The granules are piled into irregular heaps and give a dusty appearance to the epidermis cells on which they lie; often the outlines of the granules are not distinct. Many granules and shorter threads move on the addition of potash lye or acetic acid. The threads become most distinct after having been long acted upon by potash lye. Burchardt found the same threads and granules in the urine of the patient in question.

From these reddish brown spots there are all possible transitions into the coffee-brown spots of pityriasis versicolor. In accordance therewith, we also see the elements of microsporon furfur become ever more plentiful and more easily distinguishable from those of erythrasma near them. Like pityriasis versicolor, the affection is very liable to relapses.

The *treatment* of the affection is the same as that of pityriasis versicolor.

# THE PARASITIC DISEASES OF THE SKIN.

## II. THE SKIN DISEASES DUE TO ANIMAL PARASITES.

BY

PROF. E. GEBER, M.D.

THE animal parasites of the human skin inflict upon it different injuries according to the structure of their implement for boring, stinging, cutting, of the ovipositor, etc., as well as according to the force called into requisition for this purpose. Many of them also evacuate into the lesion the caustic contents of the glands (cimices, ixodæ, etc.). Others again, as for instance some species of leeches, inject with their bite poisonous fluids.

A further necessity in the acquisition of nourishment for our parasites consists in this, that they must come in contact with the skin. Many do so by remaining on the skin only during the attack; as soon as this is past, the animal retires, into the neighborhood if unable to fast long, but to any distance if it be able to exist without frequent repetition of ingestion of the nutriment (fleas, ixodæ), in which case it changes its host.

Another, not inconsiderable part of the parasites uses the skin as a domicile. They do this always in a manner appropriate to the perpetuation of the species. Animals which must seek each other sexually make their habitat in the upper layers of the skin; while others, in which propagation does not come directly into consideration, find room in the subcutaneous connective tissue. A very peculiar circumstance prevails with pulex penetrans, the female of which leaves its abdomen outside of the wound when boring its way in, so that it may scatter its eggs undisturbed over the ground. But there are parasites to which, when they accidentally get into the skin, this domicile is equivalent to destruction. The larva of tænia solium can subsist one or two or more years in the skin, but it always perishes before maturity.

We divide the animal parasites of the human skin into three classes:

I. *Stationary parasites* are such as prey almost exclusively on the human skin, but on that of animals only quite exceptionally and never permanently.

II. *Temporary parasites* or occasional parasites of the human skin. All the animals of this group are necessarily parasitical. But they differ from each other especially in this, that one part of them has a permanent host, while another is able to change their

host. In their relations to man they are all nearly equal, in that they prey upon him as they do on animals generally. Interesting here is the fact that the change of the host occurs with a certain regularity, and that this forms an essential condition to the future development of the animal (for instance, hirudines, some species of œstrus).

III. *Accidental parasites* are such as do not seek the human skin of their own volition, but once there, injure it in the instinct of self-preservation.

Each of these classes may be further subdivided, according to whether the animal lives upon or in the skin, and whether it is a parasite of man during its entire life or only during a certain period.

If we tabulate all these factors, we obtain the following table for the principal parasites.

I. *Stationary Parasites.*

Sarcoptes scabiei hominis, itch mite.
Demodex (Acarus) folliculorum hom.
Pediculus: *a.* Pediculus capitis, head louse.
*b.* " vestimenti, clothes louse.
Phthirius pubis, crab louse.
Pulex irritans, flea.

II. *Temporary Parasites.*

1. *In sexually mature condition:*

Sarcoptes scabiei communis.
Dermanyssus avium, bird mite.
Ixodæ, ticks: *a.* I. ricinus, reduvius.
*b.* Argas reflexus, persicus, americanus.
Cimex lectularius, bedbug.
Pulex s. Sarcopsylla penetrans, sand flea.
Tabanidæ, Horse flies: Tabanus, Chrysops cœcutiens. Pangonia.
Culicidæ: Culex pipiens, Simula colombacencis, S. pertinax.
Hirudinæ: H. medicinalis, officin., and others, Hæmentaria mexicana.

2. *In larval condition.*

Cestodes: Cysticercus cellulosæ.
Echinococcus, bladder worm.
Trematodes: Distoma hepaticum, liver fluke.
Nematodes: Filaria medinensis.
Filaria sanguinis hominis.
Oxyuris vermicularis.
Leptodera.
Muscidæ: *a.* M. domestica, cadaverina, vomitaria, and L. Cæsar.
*b.* Sarcophila Wohlfarti (Portschinsky), Sarcophaga cadanaria.

To these may be added: Lucil. hominivorax in America, Stomoxys calcitrans, Glossina morsitans known in Central Africa as tsé-tsé, etc.

Œstridæ: Hypoderma (vers macacaque in Cayenne), species of Cuterebra and Dermatobia (Œstrus humanus, Humboldt).

III. *Accidental Parasites.*

Species of Dermatodectes and Symbiotes (Gerlach).
Leptus autumnalis, harvest bug.
Kritoptes monunguiculosis.
Clothilia inquilis, bookworm.

## I. STATIONARY PARASITES.

1. The disease caused by Sarcoptes scabiei hominis :

### *Scabies, Itch.*

Definition.—Under the name scabies (itch) is understood a contagious cutaneous disease produced by the transmission of the human itch mite, connected with irritative conditions of the skin and intense itching; the disease is always conjoined with the presence of mites in the epidermis.

According to our present nosogenetic conceptions, it is altogether impossible to imagine scabies without the presence of acari. But it is otherwise in the opposite case. For in the numerous class of acarines there are several sarcoptides which, though parasitical, cannot become permanently domiciled on the human skin. Hence we must devote ourselves exclusively to the Sarcoptes scabiei hominis.

Natural History of the Itch Mite.—*Sarcoptes scabiei*, the human itch mite, has an oblong round shape with an upper convex and a lower slightly concave surface. The female is on an average 0.35 mm. long and 0.23 mm. broad; the male, 0.25 mm. long and 0.15 mm. broad. The body is inclosed in a delicate, transparent, loosely adherent integument and has here and there epidermidal deposits, scales, chitinous inclosures, spines, bristles, and prickles. The cephalothorax has four indentations perceptible only on the sides and otherwise forms a compact whole. It is divided from the abdomen by a transverse undulating furrow.

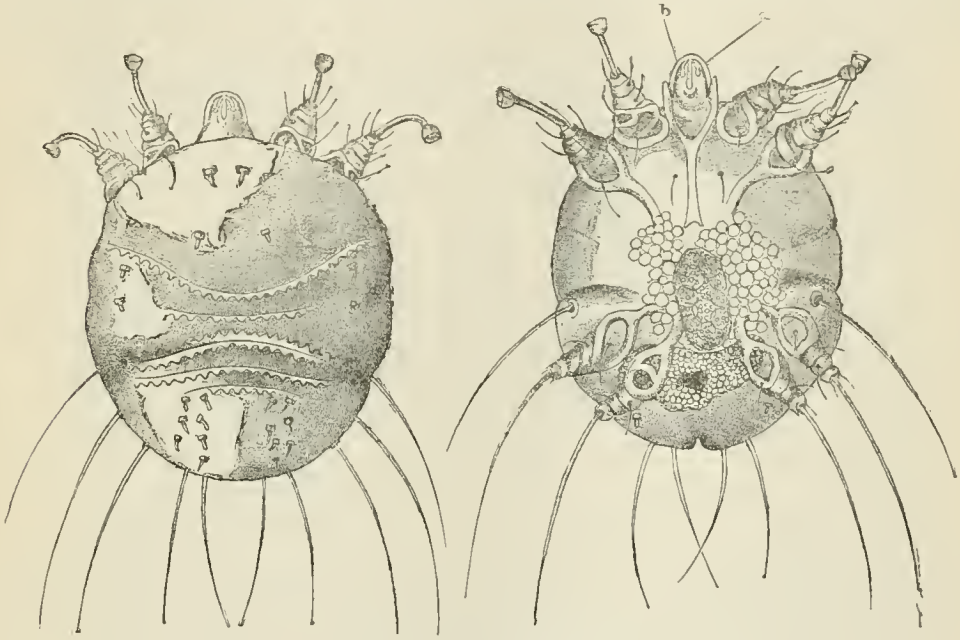
The head represents a short, anteriorly rounded, posteriorly widening, flattened, resistent, strong cone, on which the following parts can be distinguished: The integument turns back like a fold at the limit of the head and as the epistome surrounds the lateral cephalic and upper parts of the mouth (Fig. 44). In the median line are the strong movable mandibles (*b*) which, seen from above, terminate like scissors and are besides slightly serrated. This first pair of mandibles is covered above by the upper labium slightly fissured in front. Laterally, and partly touching the mandibles, is a pair of three-jointed palpi developed into an organ of touch or taste, movable at the base, and provided with two or three bristles (first pair of maxillæ) (*c*). Under the pair of mandibles, resting on a kind of lower labium, we see two, anteriorly broad, posteriorly uniting small rods of chitin, which make the impression as if they represented a rudimentary second pair of maxillæ.

On the dorsum of the animal the skin is laid into several transverse folds between which are rows of concentric small roundish elevations. At the nucha are two short strong spines which are said to aid the animal in burrowing. Around the points of attachment of the limbs long bristles (Bergh's shoulder bristles) are fastened, and behind these Bergh has counted thirty three shoulder-cones. Farther backward come rows of numerous nails and scales which probably undergo no further change with the development. On the posterior half of the abdomen are four rows of spines, numbering ten in six-legged nymphæ, twelve in males, and fourteen in females.

On the ventral side the organs of locomotion deserve special mention. Medially the long narrow ridge of chitin—sternum—is conspicuous; this, giving off two forked branches (first pair of epimeres) in an anterior and external direction, has thereby a ball-and-socket joint connection with the first pair of feet. Behind a shallow incision follows the second pair of feet with the second pair of epimeres. The other pairs of feet—one in the larva before the first moult, two in others—are situated beyond the furrow between

thorax and abdomen on the posterior inguinal ridges. Each leg has five segments connected together by ball-and-socket joints. The tarsus at the anterior pairs of feet terminates in a double claw between the two arms of which are one or two bristles. From the lower surface projects the long stem with the sucking disk. In the female both pairs of hind legs end in long bristles, while in the male the posterior inner pair of feet again carries a sucking disk on a stem. In the centre of the posterior margin of the abdomen the anal opening appears as a vertical slit. To the right and left of this, the anal bristles may be seen.

The researches on a number of the internal organs are far from being concluded. As to the digestive organs, we know through Gudden's communications that the œsophagus




Dorsal aspect

FIG. 44.—Fructified female mite, Power 250.

Abdominal aspect.

dilates behind the second anterior pair of feet into the gastric cavity which consists of a body and two lateral lobes. Posteriorly the stomach continues into the long straight intestine which terminates in the above-mentioned anal opening. Gudden moreover gives detailed descriptions of a poison or salivary gland which becomes visible with the stomach and the efferent duct of which is directed toward the head of the mite. Respiratory organs are altogether absent in our mite which breathes by means of the skin. The Sarcoptes scabiei hominis also lacks circulatory organs and vessels, for even with the highest magnifying power nothing can be seen but a free flow of a kind of lymph in wall-less currents.

Better known and described are the sexual organs. In the male (Fig. 45), we find in the centre, between the posterior inner pair of feet, on the transverse ridge separating them, the bifurcated penis holder. The latter, which has a horse-shoe shape lying in the depression, is perforated at its convex part for the reception of the immission tip. As regards the internal sexual apparatus, it is probable that there are posteriorly testes

filled with zoosperms which merge into the seminal ducts and open into the common tube situated in front of the penis. In the female, at the limit between abdomen and cephalothorax, the curved vagina is placed in the form of a transverse fissure the margins of which are slightly bent with a posterior concavity. From there the ovipositor continues medially as far as the region of the posterior inner pair of feet. The ovipositor looks like a nail cleft at the head and is capable of dilatation during the passage of the eggs. Gudden (Taf. III., Fig. 6) also illustrates very clearly the vagina, seminal vessels, ovaries, etc., situated above the anal opening. The itch mites are oviparous. The ovum ripe for extrusion emerges through the transverse fissure of the ovipositor and in the shape of an oval grayish shining body, 0.16 mm. long and 0.10 mm. broad, lies with its longitudinal axis obliquely across that of the passage. Bourguignon, Gudden, Burchardt, and Bergh justly emphasize that they have seen eggs in process of segmentation even within the body of the animal, for this occurs without exception in acarini and it explains

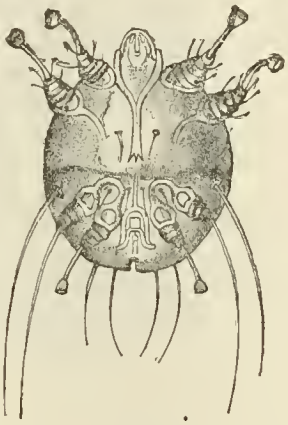


Fig. 45.

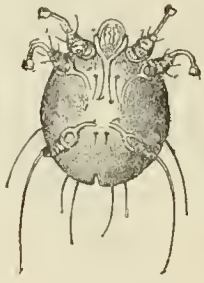


Fig. 46.

the relatively rapid (often in 64 to 76 hours) hatching of the eggs. The number of eggs found in a burrow of a mite is variable; hitherto not more than 21 to 26 were met with altogether. According to an approximate calculation, a female, during an average length of life of three and a half months, can point to a posterity of one-third million individuals.

*Mode of Life of the Mite.*—In a single burrow we never find more than one couple which have sought each other for cohabitation, *i. e.*, one male and one female. On the average in from three to six days, there escapes from the ovum a six-legged larva which is characterized by two bristles on the posterior edge (Bergh) and ten longer spines on the back. The young larva soon leaves its point of origin and digs either a lateral passage or a new burrow at some distance from it. Six days after, the first moult commences, and lasts three, four, or more days, when the animal possesses eight legs, four bristles, and twelve spines. After an equal lapse of time ensues the second moult, with the development of fourteen spines, so that the mite reaches the stage of puberty at the end of the third week. A week later, it appears sexually mature. The fully developed animal capable of reproduction now leaves its habitat, and both sexes having wandered about for some time, the female finally commences a special burrow where the male likewise arrives afterward, with a view to pairing. After fertilization, the male usually leaves the burrow altogether and digs into the neighborhood. But sometimes it

only constructs a lateral passage where it perishes in from six to eight days. Gerlach assumes that one male may fertilize several females. The female mite, having become pregnant, does not leave its burrow again, but, with a view to nutrition, advances in the succulent rete, where she continues burrowing, with the deposition of eggs. The ova are laid at variable intervals. The purpose of its life having been fulfilled, the animal remains inclosed at the head of its burrow (Hebra) and perishes. Most authors agree that the male on an average becomes eight weeks old, while the female, requiring for the laying of eggs (one to two daily) generally four to six weeks, reaches an age of three to three and one-half months, as a rule.

Symptoms and Course of Scabies.—If, for experimental purposes, we transfer to ourselves several pregnant mites, we observe that they bore into the epidermis after some running to and fro. In doing so, the animal rears on its hind legs, presses down

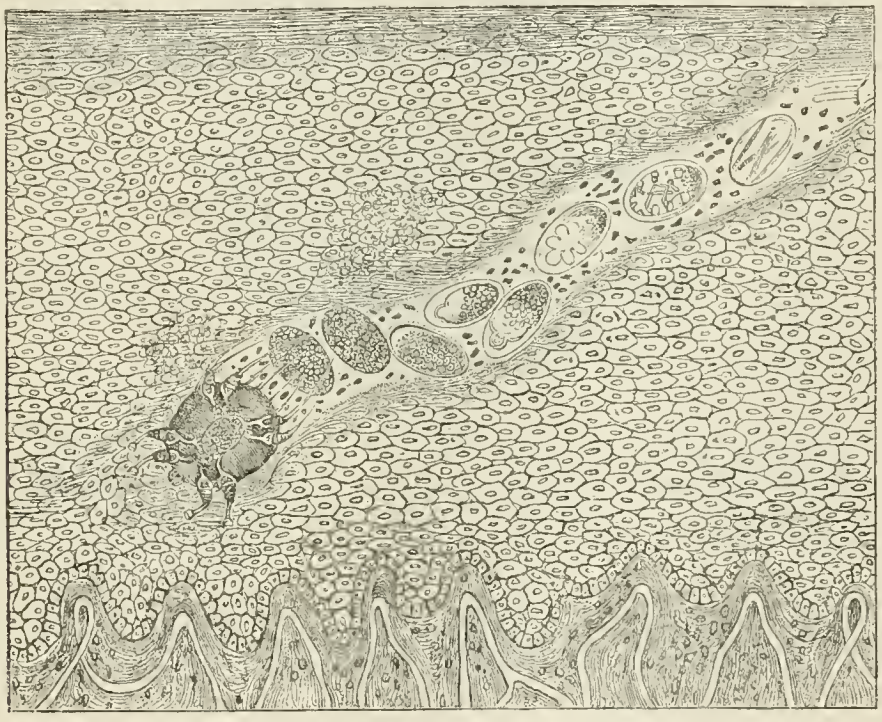


Fig. 47.—The burrow of a mite.—Schematic drawing after Kaposi.

its cone-shaped head, and the scissors-like mandibles being put into activity, the obstructions are gradually cleared away, so that it gets under the epidermis. Subjectively this is felt as a local burning or itching which is repeated at irregular intervals. Objectively we can observe here and there a small, inconspicuous, reddened elevation. In two or three days, these become more numerous, and develop into real nodules and vesicles the size of a pin's head. The itching becomes greater, so that it is difficult to abstain from scratching. Toward the end of one week, the mite advancing between the rete cells, we can see, extending from the points of attack, an undulating whitish streak, 1–2 mm. in length, which at first sight looks like a scratch of the epidermis, but in fact represents the beginning of the burrow. Gradually this becomes longer ($\frac{1}{2}$–1 mm. daily, Burchardt), and, according to the quality of the skin, presents a different appear-

ance. Where the epidermis is greatly developed, the recent part of the burrow merely becomes more succulent; but on more delicate parts of the skin—in young persons and women—it bears vesicles or small pustules either at one point or over its whole extent. Usually during this process, the mite is lifted up immediately to the epidermis. Intermediate between these are those regions (penis, nipples, etc.) where the burrow is seated on a reddened, plainly developed tubercle. As a rule, the mite endeavors to escape from this position and burrows farther forward. But as soon as it leaves its place, the irritation there ceases, and the consequence is that the efflorescence atrophies, that part of the burrows sinks down, and nothing remains there but a small scale, a dried nodule, crust, or scab. This circumstance explains the fact that, excepting one case of Hebra's who found a burrow 16 cm. in length, they measure no more than 1–3 cm.; and that, although the pregnant female, for instance, can lay up to fifty eggs, more than twenty to twenty-five are never found in a burrow.

By the time such a long burrow is finished, the young ones first hatched have already reached the stage of maturity and propagation. While these are striving to fulfil their destiny, they will produce the same conditions of the skin as their ancestors; itching, nodules, vesicles, pustules, and burrows. If we bear in mind that the mites, besides multiplying, partly wander off, partly are transferred by the finger nails in scratching to some remote regions, we shall understand how scabies may spread over the whole body from a single point.

The subjective symptoms increase in consequence of the spreading of the process, and manifest themselves in the latter case not only at the places occupied by the parasites, but, owing to the many simultaneous points of attack, the reflex, and the irradiation, the patient is forced to scratch here and there and everywhere

The following morbid picture is presented on the skin: While on the one hand the mites and their burrows increase, as well as the nodules, vesicles, and pustules produced by the presence of the animals; on the other hand, all sorts of eruptions are caused by the scratching with the finger nails.

The localization occurs in the following order of frequency: flexor side of the wrist-joint, lateral surfaces of the fingers, interdigital folds, anterior axillary folds, nipples and surroundings in women, penis, anal region, navel, etc. Or to express ourselves more concisely, we may say that the mites, their burrows, and the eruptions immediately produced by them are met with most frequently on those parts which are covered, protected, and kept in a condition of increased afflux of blood. Therefore we shall find them also where the skin is exposed to continual pressure by close-fitting articles of dress. But on this account, when the diagnosis of scabies is doubtful, we must never fail to examine such portions of the skin exposed to pressure, according to the occupation of the patient, for the presence of mites or at least of efflorescences. In infants and young children whose skin naturally is not subject to any certain continual pressure, there are generally no points of predilection for mites, and they may be found even in the face and on the soles of the feet.

The consequences of the scratching offer no peculiarities at all. They are the affections and efflorescences which we find in all chronic itching eruptions. On recently attacked places we see either a diffuse erythema or one corresponding to the scraping with the finger nails, and an urticaria which is eroded on the highest points, and with remission of the injury becomes lichen urticatus (Hebra). Where the irritations continue for a longer time and are repeated at one and the same place, artificial eczema, folliculitis,

furunculation, dermatitis, and cutaneous ulcers result. Biffon states that he has seen erysipelas in consequence of scabies.

But however variable the form of the eruption—erythema, urticaria, eczema papulosum, vesiculosum, pustulosum, erosions, ulcers, etc.—it is unchangeable in that it is largely grouped around those regions which are sought by the mites with special preference. But it happens occasionally that two or more such eruptive territories adjoin so closely that their peripheries blend with each other, thus resulting in larger patches of scabies. The region from the nipples to the knees is considered one of the largest, and termed by Hebra, with justice, particularly pathognomonic.

Fig. 48.

In exceptional cases, that is, when scabies patients remain for a long time—several years or decades—in a neglected condition, though the points of predilection are still most affected with all sorts of artefacts, the demarcation is no longer sharply limited, mites in variable quantities being met with everywhere, often on simple scraping of any crusted spot (Fig. 48).

Diagnosis.—If we bear in mind all the symptoms enumerated, its recognition will generally not offer any special difficulties. What causes the patient to consult the physician is the continuous itching, literally spread over the whole body, and increased by warmth. In response to such a statement, we should for obvious reasons first inspect the hands to discover the burrows of the mite. In order to recognize these, we must remember that they represent undulating, punctated lines which become all the more distinct by painting with ink followed by drying (Hebra). If they are found sufficiently developed on the fingers or interdigital folds, the diagnosis is determined *ipso facto*.

If no burrows are present on the fingers or cannot be positively recognized there, they must be looked for on the points of predilection of the mites—penis, umbilical region, anterior axillary folds, nipples, or anal region. In a form of scabies, such as the one we have taken as the starting-point for our discussion, the development of burrows has occurred, as a rule, on one or another point. If it is probable that they are such, and a magnifying glass is at hand, we should not fail to fetch the mite out of its supposed burrow. If not skilful in catching the mite, it is advisable to compare the two ends of the burrow. At the point where the mite is located, we shall either at once see

a small roundish yellowish-white body glistening through the epidermis, and in that case, there will be no particular difficulty in lifting the animal out of the epidermis layer by means of a point of a lancet inserted superficially and diametrically to the longitudinal axis of the burrow. Or else the mite cannot be distinguished at either end, and then it should be borne in mind that it does not stay at the dried, but at the succulent, knob-shaped rounded end. The lancet should not be carried too deep, otherwise the mite, especially when a vesicle is present, will be lost with the fluid. If the mite has been secured, it should be remembered that it adheres rather tenaciously to the point of the lancet in the shape of a small, at first motionless body, appearing globular to the naked eye. Whoever is altogether unable to acquire the knack of catching mites will do best to remove the burrow in toto with scissors, razor, or lancet, and then to examine it under the microscope properly flattened between two slides.

But often neither burrows nor mites are to be found, either because an ineffectual treatment may have been undertaken or the patient has removed them by some mechanical means; then nothing is left but to gain information as to the presence of scabies by inspecting the points of predilection. If there are in the region of the anus, the genitals, the nipples, etc., circumscribed eczematous symptoms, we can assert, independent of the burrows or the pustular forms otherwise largely relied upon, that scabies either is or was present.

Treatment.—The indications to be met by a complete treatment of scabies consist in this, that the mites are killed, and the irritative conditions, artefacts of the skin, removed. But this twofold aim will be best reached when we most scrupulously avoid all caustic substances, and employ only such agents as unite special destruction of the mite with the preservation of the skin.

Of the drugs employed may be enumerated: Sulphur, a large number of ethereal oils, ol. lavandul., caryophyllor, roris marini, menthæ, cinnamom., etc., balsamus peruvian., styrax; tar, infusions and decoctions of black hellebore, fol. nicotian., baccæ lauri. In recent times, petroleum, naphthol, and naphthalin have been recommended.

In order to facilitate the penetration of these drugs into the hiding places of the mites and at the same time effect the cure of the artefacts, eczema, etc., they are employed in the form of ointments, mixtures, or solutions according to individual preference. Often other drugs are mixed with them.

In the following paragraph the most reliable prescriptions will be mentioned:

Rp. Sulph. venalis, 5 to 10 gm.; and Butyr. recentis or Adipis, q.s. (For country and poor practice.) Also: Styracis liquid., alone or combined with Ol. lini (4 : 1). Bals. peruv. (10 to 20 gm.) alone or with equal parts of styrax may be used. This prescription is particularly appropriate for children. —Clemens recommends: Acid. arsenicus, 0.05; Potass. carbon., 1; Spirit. saponat., 10; and Aqu. font., 1000 gm.—Where there is present at the same time an extensive artificial eczema, it is advisable to rub in twice within twenty-four hours Wilkinson's ointment as modified by Hebra: Flor. sulph., Ol. fagi, ana 40; Sapon. virid., Adipis, ana 80; and Creta alb. pulv., 15 gms.—In order to avoid soiling of the linen, Weinberg has substituted the same amount of styrax for the ol. fagi in the last prescription. But thereby the cure of the eczema—the original intention—has been lost sight of. Kaposi orders for simple scabies: Naphthol, 15, cum Ung. simpl., 100 gms., and where eczema is present adds thereto: Sapon. virid., 50, and Cret. alb. pulv., 10 gms. I have employed naphthol for two years with very satisfactory results. Fürbringer recommends naphthalin in a 10 to 12 per cent solution with linseed oil. He has convinced himself in 60 cases that three to four inunctions (within twenty-four to thirty-six hours) are sufficient to cure the itch. For simple cases we might recommend the long established natural and artificial sulphur baths, as well as the sulphur-sand soap prepared for this purpose. In France, Helmerich's sulphur ointment is largely employed: Sulph. puriss., 2; Potass. subcarb., 1; Adipis, 8 parts. Bourguignon has modified it in the following way: Gummi

tragacanth., 1; Potass. subcarb., 50; Sulphur. puriss., 100; Glycerin., 200; and Ol. lavand., menth., etc., ana 1 gm. Hardy has changed in Helmerich's oiutment merely the proportion of the sulphur to the lard (1 : 12).

Whatever remedy or prescription is used, satisfactory results will be obtained only where the mode of employment is correct. The remedy should not be rubbed in too vigorously, and the sites of predilection of the mites must be first and almost exclusively attended to, other parts of the skin, such as the flexor side of the elbow joint, are simply painted.

In the Hôpital St. Louis at Paris, Hardy employ the following mode of rapid treatment: Patients qualified for it (sic!) are washed with black soap and rubbed off, after which they take an ordinary bath for half an hour. Then the patient is again thoroughly anointed for half an hour with the above-mentioned ointment (Helmerich's modified ointment) and left for awhile in this condition. With another bath for cleansing purposes the treatment terminates after two hours.

According to Hebra and his school, the patient anoints himself without any preparation with the modified Wilkinson's ointment or any liniment so as to take the points of predilection first separately, and then the whole body, the face remaining free. Then he dresses in some woollen fabric or is wrapped in woollen blankets. After twelve hours, the patient repeats the same procedure and this completes the cure, so that the treatment of the itch lasts twenty-four hours. For ordinary cases this procedure is perfectly satisfactory, and after from two to four days, the patient can take a bath. But when the itch is of long standing, the skin consequently more irritated, and larger surfaces present an eczema, this condition requires a special appropriate treatment after employment of the itch ointment. In general eczema the body is first painted with oil, and when the weeping has ceased altogether, with tar. For circumscribed eczematous patches it is advisable to use diachylon ointment in the ordinary manner. The pustular eruptions on the hands are best treated with daily sublimate hand-baths (1.5) lasting from one-half to one hour.

Prophylaxis.—Some still advise precautions against a second reinfection. We can concur herein only in so far as it is desirable to change the bed and body linen.

## DEMODEX (ACARUS) FOLLICULORUM HOMINIS.

With lateral pressure to the skin of the nose, forehead, cheek, lip, on the external auditory meatus, behind the ears, etc., there is discharged from the efferent duct of the follicle a consistent, soft sebaceous mass which, when lightly rubbed with a drop of oil or glycerin, permits the recognition of living animals even under low powers of the microscope.

Demodex hominis is 0.30 to 0.40 mm. long, has an elongated wormlike form, and has clearly developed cephalic, thoracic, and abdominal parts.

The head is marked off from the thorax by a bandlike streak running on the posterior side, occupies about the fifth part of the entire length of the body, becomes broader and thicker in an antero-posterior direction, and the following parts can be distinguished on it: In front and laterally are two pedipalpi (Fig. 49) which are freely movable, three-jointed, and capable of being rolled in. Between the palpi and united with them by a joint is a pair of upper maxillæ or mandibles movable only in a horizontal direction like scissors. Extending from above downward, adjoining the mandibles at an acute angle, are the lower maxillæ or jaws which merge together at their posterior end, and

must be regarded as masticatory implements. Between these extends from in front backward a narrow, barely perceptible membranous tube, the œsophagus, which dilates into the stomachic cavity in the neighborhood of the fourth pair of feet.


Fig. 49.

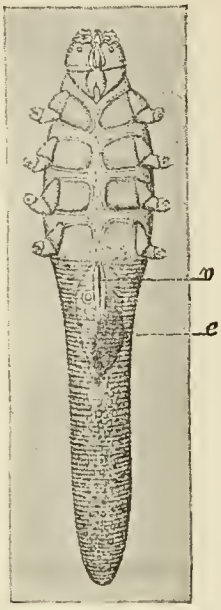



Fig. 50.

Fig. 51.

Fig. 49.—Male with genital apparatus.
Fig. 50.—Fecundated female with vagina and ovary.
Fig. 51.—Shows the first traces of an embryonal development.

The thorax, in the mature animal about one-fourth of the entire length, represents a cylinder narrowed toward each end, and is bordered in front and above by the head, and behind and below toward the abdomen by a furrow. Seen from the ventral surface, we observe on each side four or five doubly-contoured horizontal chitinous ridges extending from the margin toward the centre which elongate forward and backward to meet the adjoining ones, thereby producing on the one hand an apparent longitudinal ridge in the centre, and on the other divide the lower surface of the thorax into as many fields joined by membranes. Only the most posterior pair of these epimeres does not extend as far as the margin and thus represents a kind of false rib. Into each of the four anterior epimeres is inserted one pair, altogether therefore an equal number of limbs. Each leg consists of coxa, tibia, and tarsus. The coxa has a triangular form and at its joint with the epimere is movable only in a horizontal direction. The tibia represents a strong cone and is movable in two planes vertical to each other. The tarsus consists of a single piece gradually tapering in front; laterally it has large claw-like processes and between these a delicate flexible whip-shaped bristle. In the dorsal position of the animal, the only noticeable things are two lateral strong pieces of chitin inserted in the skin, extending from the occiput to the second pair of feet which serve the animal as a sort of carapace. On some animals there is laterally from the first to the third pair of feet a small knob, hence three pair altogether, which Wedl considers to be stigmas and is inclined to bring them in connection with the respiratory apparatus. I have convinced myself on a number of specimens that they are spines occurring only on male individuals.

The abdomen has the shape of a glove finger, tapers gradually toward the posterior, and is rounded at the end. Its length is nearly half that of the body, and its envelope is delicately ringed, while on the back the tracing extends only to the second pair of feet. At the anterior part of the lower surface the anal opening appears in the form of a small longitudinal cleft.

The digestive tract begins at the maxillæ as a delicate narrow tube, dilates in the region of the fourth pair of feet to form the stomach, then again narrowing into the intestine, and terminating in the abdomen with the vaginal opening as a common cloaca.

By careful focussing of the microscope we can see in the female, in the region of the vaginal slit, a small tube dilating posteriorly. The latter represents the ovary and the former the oviduct. By equal precision we can also demonstrate the male procreative organs (testicle and penis). Since the discovery of the animal a question has been raised but not decided up to the present time, whether the demodex is oviparous or viviparous. By culture experiments I have had the opportunity of following the development of the animal from the first traces to the formation of the various organs, and I believe it to be oviparous. As in the mature animal the organs of the vegetative system are striking in their proportions, so also in the embryo it is the masticatory apparatus which shows the first rudiments of structure (Fig. 51). In the further development follow the stumpy feet, epimeres, etc. A young larva therefore possesses a completely developed masticatory apparatus, three pair of extremities, and a short digestive tube with a relatively short abdomen. Gradually the abdomen becomes longer, the masticatory apparatus grows proportionately, and after the fourth pair of legs has also developed, we have before us a sexless nympha. Until the animal acquires the sexual parts it changes its exterior in many respects.

An interesting question which has engaged entomologists until now is, whether the acari folliculorum present in men and animals belong to one and the same variety.

But however contradictory are the experimental results and clinical observations in regard to the identity or difference of the human and animal follicular acari, authors are unanimous in stating that the demodex of man is considerably larger than that of animals. If we bear in mind, moreover, that the mode of life of the demodex varies with its host, we may assume with great probability, despite the uncertainty as to transmissibility, that there are several species of demodex as there are of sarcoptes.

Microscopic sections carried through various parts of the skin of the face show that the mite rests head downward in the follicle, the tail pointing upward. The number present in any one follicle is very variable, there being sometimes only one, sometimes from twelve to sixteen. The simplest and most reliable method of securing them is to force the contents of the follicles on the ala nasi to the surface by lateral pressure. If the mass obtained be then rubbed up with a little oil in such a manner that it forms a thin, quite transparent layer on the slide, even a tyro in the use of the microscope will not fail to recognize the animals by their peculiar shape, with moderate magnifying power.

In the new-born the demodex does not occur. I have found it once respectively in a two and a four year old child. Its favorite sites are the nose, lips, chin, forehead, and cheeks. Henle and Berger have met it in the cerumen, Wilson on the abdomen, Remak on the back, Gross on the mons Veneris, and Gruby on other parts of the body.

The presence of the demodex has absolutely no morbific influence on man, in contrast with the effect on animals (dogs and hogs). Remak alone cites a case of acne eruption in the face and on the back which is said to have arisen through the demodex.

As regards the frequency of the demodex, according to my experience with more than two hundred individuals, I side with Wilson in that there is hardly any grown-up person on whom they cannot be found, often indeed only after a long search.

## PEDICULOSIS.

Synonyms.—Phthiriasis, Morbus pedicularis, Prurigo pedicularis (Willan).

Willan is generally charged with being an adherent of phthiriasis because he speaks of a P. pedicularis. But if we learn from his book, under prurigo senilis, that this condition of the skin is said to be favorable to the occurrence of the human louse, yet that these insects are brought forth in the inhabitants of dirty, bad apartments, and in the inmates of prisons, etc., that the nits are deposited on the small hairs of the skin, and that the lice are found only on the skin or on the linen, and not under the epidermis, then we must confess that Willan ranks the equal of the most reliable observers of the present time, in regard to his clinical conception. Bateman finds the wonderful stories about affections caused by lice astonishing and thinks that they probably rest on error, the writers having mistaken other insects or their larvæ for lice. The doctrine of phthiriasis is dealt with, if possible, even more harshly by the later English writers, Plumbe, A. T. Thomson, E. Wilson, T. Fox, and others.

Among the German authors there are but few who spoke in favor of phthiriasis. As one of its most prominent adherents we must name C. H. Fuchs. According to him, mites resembling lice are said to arise in the unbroken skin and to come forth from peculiar opening tumors.

Alt claims to have found, in two cases of phthiriasis observed at the clinic in Bonn, a species of pediculus peculiar to this disease, which he calls P. tabescentium. Therefore, Alt says, though in harmony with the progress of science we can no longer speak of lice as originating in the tissues of man, still the peculiar kind of lice found should contribute towards explaining the nature of the disease.

Nearly thirty years later, Dr. Gaulke, of Insterburg, reported a series of cases of so-called "genuine phthiriasis" which is said to have been produced each time by the pediculus vestimenti. All these cases are said to have had this in common, that the lice were present to the number of thousands in cavities one-quarter inch deep or in livid red portions of the skin having a thin covering and resembling abscesses. Inspection with a magnifying glass of the closed cavities, covered with a parchment-like skin, disclosed on the surface pores the size of a pin's head, and they felt like a sac filled with shot. When they were evacuated, a number of lice were seen to crawl in all directions, but not a drop of pus could be observed. As to the manner in which so large a number of lice could penetrate into the depth of the skin, Gaulke expresses the view that the pregnant animals pierced the skin with their anal sting in order to lay their eggs under the epidermis.

Leonard Landois, in his notable "historico-critical investigations on phthiriasis," has arrived at the result that not all the cases of phthiriasis cited in the literature were really such, that the disease consists in an increase of the pediculus vestimenti, that therefore Alt's separate species of pediculus tabescentium does not exist, and that in cases of grave disease the animals in question enter the human skin in large numbers and there cause either open or covered pedicular ulcers.

Hebra did not meet with pedicular ulcers, nor did he find lice under or in the skin; they were to be found always either on the hair, hairy parts, or the clothes.

Hebra's argumentation has not convinced either Landois or Gaulke. Landois, in his

answer, first determined the conception of phthiriasis, and having by a critical sifting separated all the cases not belonging here, he found that there is no lack of cases from ancient and more modern times proving the occurrence of lice in pustules and buboes of the skin. By such proofs Landois is sure that he has removed every doubt existing in regard to phthiriasis, and hopes that Hebra too will coincide with him after considering all the facts enumerated.

It will surprise no one, however, that Hebra persisted in his assertion as originally expressed, and thought himself justified in concluding his reply by stating "that there is not and never has been any phthiriasis."

And, indeed, since then all modern physicians and specialists unhesitatingly adopt Hebra's view. Here and there only we see an apostle of true "phthiriasis" turn up. Thus Bertu tells us quite lengthily that there is a spontaneous phthiriasis and that it is a grave or even fatal disease in which pediculi form in the body and finally reach the exterior through the natural openings or through buboes, abscesses, etc. A case of acute phthiriasis (fièvre pediculaire aigue) is reported by Bleykärts. In an otherwise healthy woman, a few hours after delivery, a rigor is said to have appeared and with it so large a number of lice on the whole body that not even the bedding could be changed rapidly enough.

Since that time, to my knowledge, not a single case of true phthiriasis has been reported.

I believe that we may use the word phthiriasis in the sense of pedicular disease, not only because it is etymologically correct, but also for the reason that the effects produced by the lice on the skin represent so pronounced a clinical picture that we need for it equally as in scabies a term comprising the nature of the affection, and this all the more because the ordinary designations, such as excoriationes e pediculis, etc., do not suffice.

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The family of the pediculinæ contains wingless insects, the body of which is distinctly divided into head, thorax, and abdomen. The head is an oblong oval, and has on its anterior part two lateral five-jointed antennæ. Behind these are two non-facetted point-like eyes. At the most anterior part of the head the integument is continued as the so-called proboscis sheath, from which the animals, when feeding, protrude the proboscis into the object attacked. On each side of this proboscis are four two-jointed hooklets of chitin which probably serve to steady the proboscis during sucking.

The thorax is small, narrow, barely ringed, and provided with a stigma between the first and one between the second pair of legs. Jointed to the thorax are also three pairs of hammer feet similar to locomotive organs. The tarsus is almost without exception two-jointed and ends in a strong claw.

The abdomen has from seven to nine distinctly formed segments, at each lateral margin of which a stigma is to be observed.

The pediculinæ are oviparous, the female gluing the pear shaped eggs (nits) either to the lower part of the hair shaft or in rosary-like strings into the folds of the clothes. When the animal has developed to maturity in the ovum, it raises the operculum at the top and emerges sexually mature.

The family of pediculinæ is divided into the species of pediculus—true louse—and into that of the phthirius—crab louse.

I. The former is subdivided into two varieties—pediculus capitis and pediculus vestimenti.

1. *Pediculus capitis s. cervicalis.*—The head louse of man has a length of 1–2 mm. and a breadth of 0.6–1 mm. The female on the average is a few millimetres larger than the male. The head louse is smaller than the clothes louse, and is recognizable at first sight by the triangular form of the head. Its color is gray with blackish margins; but it changes its color with that of the skin of its host. Thus the head louse on Esquimaux is white, on negroes black, on Chinese yellowish brown, etc. The head louse increases with remarkable rapidity. The female, as a rule, lays from fifty to sixty eggs which are glued to the lower part of the hairs and from which the young emerge after six days. Within from seventeen to twenty days the animals are capable of procreating.

Symptoms and Course.—In order to overcome the annoying itching, the person infested with lice is forced to scratch, and this he does not only at the point of attack, but all over the scalp. However, this provokes a rather extensive inflammation which is succeeded by the eruption of nodules and pustules. When of longer standing, the pustules, the weeping spots and their dried secretion become more plentiful. If the lice have become domiciled in midst of a profuse growth of hair, the latter are glued together, felted by the forming secretion, causing plica polonica. That all sorts of fungi, etc., may settle in such a confused mass of hair, both at the same time and subsequently, is self-evident. Yet in by far the greatest number of cases of plica polonica the head lice play the chief part.

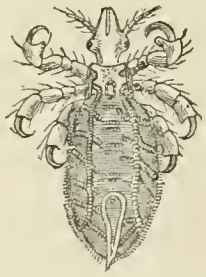

Fig. 52.—Male head louse.

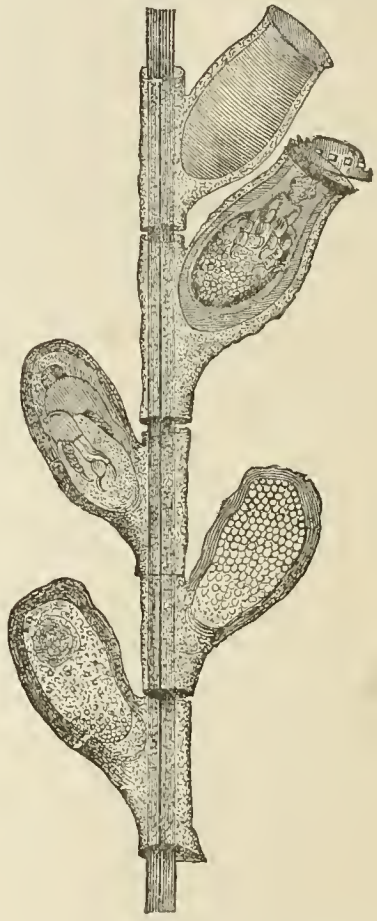

Fig. 53.—The nits, fastened by means of chitinous material to the hair, represent the several stages of embryonal development. At the upper end of the hair the young louse has left the shell.

Sometimes the neighboring glands (lower maxilla, neck, and nucha) swell, often even suppurate, and finally break open. Such glandular swellings were formerly looked upon as a sign of scrofulosis, syphilis, etc. According to the degree of sensibility of the skin, especially in young persons, there appear, even in the neighborhood of the hairy scalp, vesicular and pustular eruptions which, in case of still further

neglect, soon spread over a large part of the face, neck, and back. Many look upon an eczema of that nature as characteristic of the presence of head lice.

Treatment.—The treatment of a process due to the presence of head lice is exceedingly simple. In the first place, we must proceed against the lice. And for this we have in petroleum such a sovereign remedy that a single application suffices to kill the lice completely. Owing to its disagreeable odor, it is advisable to employ it with an equal quantity of Peru balsam. The artificial eczema present is next to be taken in hand. This can generally be completely healed in from one to two weeks by continual washing of the head with green soap and oil (ol. olivæ). It is much more difficult to get rid of the nits if the hair is to be preserved, and this must be especially borne in mind in the case of women. The eggs are so firmly fastened to the hairs that even concentrated solutions of caustic potash will not detach them. Thus far I have always succeeded by repeated washing of the hair with a saturated soda solution.

2. *Pediculus vestimenti s. corporis s human.* The clothes louse is 2–3 mm. long and 1–1.5 mm. broad. The color of the animal is dirty gray or has a yellowish cast. The thorax is distinctly separated from the abdomen. The latter is sparsely set with hairs, has a yellowish color on the margins, and has eight segments. According to Giebel, each tibia carries at its end, on a projection, a rod of chitin surrounded by large bristles. In the female this projection is of the same size throughout, while in the male it is larger on the first pair of feet than on the others. The males are smaller and less numerous than the females. The female lays, on an average, from seventy to eighty eggs, from which the young emerge in from three to eight days, and are capable of reproduction after fifteen or eighteen days.

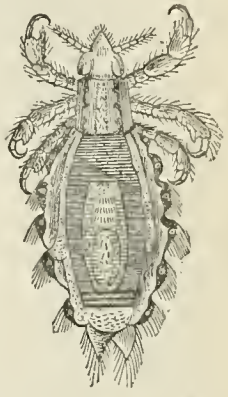

Fig. 54.—Female clothes louse.

On inspecting persons infested with clothes lice it is not difficult to become convined that the insects live in the clothes solely and seek the body merely to obtain nourishment. But this is not intended to mean that the clothes louse is never to be found on the skin; in greatly neglected cases it is not rare to see them wander around there. Some of them are met with exceptionally on excoriated or ulcerated parts of the skin; but this does not justify us in believing that this is their first and permanent domicile.

If we place into the cavity of a recently opened furuncle, the inner walls of which have been carefully cleansed of blood and pus, several dozens of clothes lice, we shall find in twenty-four hours that not a single louse has remained alive. The same took place in a case of extirpated atheroma and another time in a lipoma. In the latter two cases the cavity was even left quite uncovered, and still the animals fell victims to the experiments. From these results and the arguments against true phthiriasis brought forward by others, I must conclude that the pediculus vestimenti can live neither in abscess cavities nor in or under the skin.

Symptoms and Course.—If we would acquire a correct idea of the symptoms pronced by clothes-lice, it is best to observe a single such louse at work. At first it runs aimlessly around on the skin, then it settles down and projects its proboscis into the epidermis. With sufficient attention, the person feels at the same time a slight stinging which soon subsides. The louse raises its abdomen a little so that it stands obliquely to the direction of the sting. Now the body of the animal begins to be colored until it finally becomes intensely red from the contained blood. Then the louse desists and the first

act of the procedure is at an end. But not so its consequences. At that spot we observe a small hemorrhagic point which is surrounded by a pale raised areola (urticaria efflorescence), where the individual now feels considerable itching which he endeavors to allay by scratching. But relief is not attained until the vessels of the papillary body at the site of the wheal have been depleted of blood, *i. e.*, have been scratched open. Thus there appear on the surface of the wheal one or more drops of blood which, soon drying, form small crusts.

In order to satisfy the extensive itching produced by numerous lice, there will be formed erythema, wheals, and excoriations even where the skin has not been injured by the lice. For it is unquestionable that we are not always able to locate correctly the itching caused by lice, whence the patient scratches likewise on parts distant from the points of attack, thus producing the disproportionately large number of efflorescences.

If we inspect such a skin more closely, we find, in case some time has elapsed since the last attack by lice, on some circumscribed spot, recent and older blood crusts of roundish irregular form, isolated or in a certain linear arrangement. The latter form is produced by the patient, in order to scratch effectually, setting down the thumb as a fixed point, and digging long bloody streaks with the other four fingers.

Diagnosis.—The marks become important for the diagnosis only by their localization. For the attentive observer must be struck at first sight that the scratch effects in pediculosis mainly occupy those regions of the skin which correspond to the folds of the clothing. This concurrence is so regular that where clothes lice are present, the attacked portions of the skin change every time with the kind of clothing worn, and often it is the establishment of this fact which leads to the discovery of the object at fault.

Should this condition continue for months, the clinical picture acquires a different aspect, not only in so far that the scratch effects are spread diffusely over the whole body, but in the mean time the secondary efflorescences—pustules, eczemas, furuncles, and utaneous ulcers—have multiplied materially and left traces in the form of all sorts of cicatrices and pigment spots. On a skin thus treated, therefore, we may observe all possible transitions from the simplest erythema to the most advanced form of inflammatory destruction and retrogression. The latter may even predominate to such an extent that nearly the whole skin looks brown or black.

Moreover, if we take into consideration that such people belong to the poorest classes, we will understand that persons suffering thus are liable to other bodily ailments and generally fall a prey to invalidism. Recently I had in my ward a patient affected with various species of lice, who, although no other disease could be demonstrated in him, and in spite of the fact that he enjoyed a, for him, luxurious (hospital) care, after two and a half months' stay in the hospital, had been unable to recover sufficiently from his marasmus to be capable of standing even a few minutes. Such cases of supposititious "genuine phthiriasis" might indeed terminate fatally, but it is questionable whether in such a case there is any plausible reason for ascribing the unfavorable termination to the presence of the lice or whether we must not rather assume that the neglected mode of life is the sole cause.

The treatment consists in keeping the body clean (bathing and washing), and the removal on dermatological principles of the irritative conditions. In order to guard against a possible return of the affection, the clothing, etc., must be most carefully cleansed by washing, or by keeping it at the heat of boiling water for forty-eight hours.

II. Phthiriasis inguinalis s. pubis, Pediculus pubis (Linné), Morpion, Crab Louse.

The crab louse is distinguished from the last described species by the broader head,

which is joined to the thorax by a neck-like prolongation. The abdomen has a heart shape and is provided with eight segments, the first three being very small and only indicated by the stigmata. The first pair of feet is comparatively delicate and has a small claw at its end. The other two become stronger towards the tarsus and end in a sort of sting which, turned inwards, becomes a forceps with the tarsus. The male is 0.8 to 1.0 mm. long and 0.5 to 0.7 mm. broad and thus from one to one and a half mm. smaller than the female. The pear shaped eggs, ten to fifteen in number, are fastened by means of a sheath of chitin in the lowest possible part of the hair. From these the young emerge after from six to seven days and become capable of reproduction in two weeks.

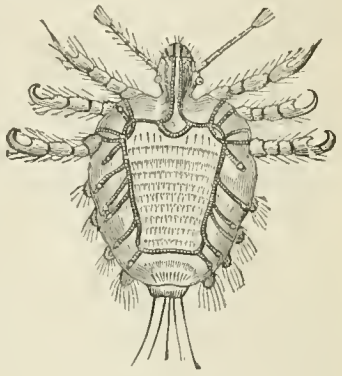

Fig. 55.—Crab Louse.

The crab louse occurs most frequently on the mons veneris and generally spreads thence over the neighboring regions, downwards over the thighs and legs, upwards over the abdomen, chest, axillæ, beard, and the eye-lashes. But it is not impossible that they may be first met with on one of the regions mentioned (in children on the eye-lashes). This depends on the mode of transmission. Coition offers the most frequent opportunity, but the infection may be communicated also by the clothing, linen, bedding, etc.

Although the phthirius, like the other lice, injures the skin only when feeding, the symptoms are much more intense. If the patient be questioned about the manner of scratching, we are told that, as soon as the itching appears, the necessity to insert the nails deeply becomes irresistible. The result of these efforts finally is an extensive eczema appearing in the form of papules, vesicles, or pustules. In particularly stubborn cases the eczema may extend over large surfaces or degenerate into a dermatitis.

*Maculæ ceruleæ.*—We must here make mention of another quite interesting symptom of phthirius, the maculæ ceruleæ or taches ombrées of the French. In persons of both sexes infested with phthirii we not rarely observe steel gray spots, the size of the little finger nail, which fade but slightly under pressure, occur generally according to the locality of the lice, cause no disturbance, disappear after a few days, and cease altogether with the destruction of the animals.

In 1868, Mourson demonstrated that there was a causal connection between phthirius and the taches ombrées. In 1880 and 1882 Duguet published the results of his investigations, according to which the spots are due to the evacuation of the contents of the salivary gland, situated on the thorax, under the epidermis, and are not connected with any further alteration of the skin.

Treatment.—Since the employment of mercury in medical practice, it is the custom to use unguentum cinereum—popularly known as "blue ointment"—against crab lice. And it cannot be denied that two frictions of a piece the size of a bean each suffice to kill the animal. But it is equally certain that if the necessary caution be neglected, the ointment will produce a stubborn artificial eczema, more especially because the patient is generally unable to establish the death of the animals, and is likely to continue frictions on account of the itching, now due to the eczema. I therefore advise to use from the start either petroleum, some ethereal oil, Peru balsam alone or in combination with petroleum. In order to dispose of the young subsequently hatched, it is necessary to repeat the procedure several times at intervals of eight to fourteen days.

### PULEX IRRITANS. THE FLEA OF MAN.

The flea possesses a laterally compressed body and has a brownish red color. The male is 2 to 5 mm. long and 1 to 2 mm. broad. The female, on an average, is twice that size. The oral parts are arranged for sucking and consist of a pair of serrated soft mandibles, a single tongue suitable for stinging, a lower labium forming a sheath for the former, and a pair of labial palpi with four joints each. The thorax is divided into three segments, each of which is provided with a pair of legs. The latter increase in length towards the posterior, are five-jointed and have very strong femurs, with two claws on the tarsus. Eyes, respiratory organs, and genital apparatus are distinctly developed. The female lays within twenty days the same number of eggs into fissures in the flooring, the folds of the dirty wash, etc., and from these the footless, worm-like, fourteen-segmented whitish larvæ emerge after from six to eight days. The nympha is inclosed in a coccoon. Only after the flea has undergone its metamorphosis into the fully mature insect does it seek the human skin for its nutrition. Its bite, with which it at the same time injects an irritating fluid, is barely perceived at the moment. Gradually there is felt a local itching of short duration, conjoined with wheals in persons with delicate skin. When the animal is satiated, it leaves the skin and we perceive a small hemorrhagic point surrounded by a hyperæmic areola. The latter disappears in a few minutes, while the exudation of blood continues for several hours. In neglected persons the flea bites may be present in such large numbers that for an instant, especially when a febrile condition coexists, they may simulate the picture of morbilli, scarlatina, etc.

The human flea may change to the dog and back again to its original host. But the dog flea never preys permanently upon man.

## II. TEMPORARY PARASITES.

### 1. *Animals Parasitical in a Mature Condition.*

*a. Sarcoptes scabiei communis.*—Under this head are comprised all the mites which burrow and the females of which live in canals. Hence the Sarcoptes scabiei hominis really belongs among them. This has been treated of separate from the other species (S. equi, suis, ovis, canis, lupi, vulpis, etc.) in deference to its parasitical character towards man. For although sarcoptologists are unanimous that both anatomically and physiologically there are only quite immaterial differences between the several species—and physicians and veterinarians are well aware that, when transferred, the mites of Sarcoptes major burrow under the epidermis, the females construct canals, lay eggs, from which young are hatched, in short that there ensues an itch spread over the whole body—still experience has shown that the mites are unable to adapt themselves definitively, and that such an itch is always of limited duration (never beyond six to eight weeks) and that therefore spontaneous recovery is the uniform result. Hence all the mites named cannot be looked upon as true parasites of the human skin, but only as such as are liable to produce temporary scabies.

This is true in a still greater degree of the mites of sarcoptes minor. These when transferred produce only a local eczematous eruption lasting several days which terminates within three or four days with the death of the animal.

*b.* In the family of the Gamasidæ there are two species of dermanyssus which show a certain predilection to pass from birds to man. These are D. gallinæ and D. avium. They

have a soft skin, breathe by means of tracheæ, and have no eyes. The mandibles in the male are changed into a lancet-like dagger, in the female into a delicate stiletto. The legs are hairy and end in two claws and a sucking disk. D. gallinæ is smaller and of a yellowish color, while D. avium is grayish.

Both species are numerous in fowls, birds, in their nests and in dove-cotes, whence they escape by night into human habitations in order to attack man during sleep and when gorged with blood to return at dawn into their hiding places. In one of my patients D. gallinæ had caused a diffuse eczema lasting about four weeks. The eruption always heals spontaneously.

*c. Ixodes, Ticks.*—This family comprises a considerable number of periodical parasites which are spread over every region of the globe. The flattened body provided with a firm dorsal shield, and great bloodthirstiness, are common to all. The barbed maxillæ are changed into a long proboscis which incloses the protrudible maxillary palpi with serrated terminal segments curved like a claw. They breathe through tracheæ and possess large salivary poison glands (?). Each of the eight legs ends in two hooked claws.

*Ixodes ricinus* (wood beetle) is spread over nearly the whole temperate zone. The male is up to 3 mm. in length and half as broad, the female is generally twice that size. This tick is found in woods, on pines and bushes, where it waits for passing men and animals in order to attack them. The animals are in the habit of boring the proboscis imperceptibly into the skin and gorge themselves to such an extent that they swell to the size of a castor seed; they then let go, drop to the ground and remain there until they repeat the operation. But if it is a female, the numerous eggs are first safely deposited in an appropriate place, a few days after which it dies.

The injury inflicted by the tick is hardly perceived at first, the troublesome sensation ensuing when the animal is gorged. Subsequently there remains usually a small wheal-like or circumscribed papular inflammation. If the animal be removed forcibly, the proboscis tears off and remains in the wound, causing violent pain.

In order to render the wound as harmless as possible, we must either wait until it has gorged itself and drops off, or paint its body with oil of turpentine, etc., whereby it either perishes (closure of the stigmas) or spontaneously retracts the proboscis. With us there occur, besides, ixodes reduvius and argas reflexus which occasionally trouble man.

Of the species of argas occurring in the tropics should be specially mentioned: 1. Argas persicus (Persia and Egypt), and 2. Argas americanus, chincha (Colombia). By their bite both cause rather intense persistent pain, and the latter is even said to be fatal to strangers. But they become a veritable plague when they get into the houses because it is almost impossibe to eradicate them and they bleed men at will, attacking them during sleep.

The literature of the ticks has been recently most carefully compiled by Megnin in the *Journal de l'Anatomie et de la Physiol.*, 1882, No. 4, to which I refer.

*d. Cimex lectularius, Acanthia lectularia, the bed-bug.*—The body has an oval form, is wingless, brownish red, 5 mm. long and 3 mm. broad. Mandibles and maxillæ joined into a tubular sucking apparatus, surrounded by the lower labium. Tongue, as a stinging apparatus, inclosed in the sheath. Glandulæ odoriferæ on the metathorax.

Its usual resorts are old furniture and neglected apartments. It is remarkable how, aided by its sensory apparatus (sight or smell ?), it deliberately moves along, for instance, on the ceiling of the room, to the desired spot so as to drop directly upon the scented object. Its bite is affected by first inserting its sting into skin, and then, in order to ob-

tain a larger quantity of blood with greater facility, by evacuating its voluminous poison gland, provoking a reaction connected with hyperæmia. The consequences are that, besides the slight lesion, large wheals form which itch greatly and are not easily distinguished from commencing prurigo.

*e. Pulex penetrans* (Sorcopsylla Westwood, Genus Rhynchoprion Oken).—The sand flea, called by the inhabitants chique pique, nigra, etc., occurs from the 29th degree of South to the 30th degree of North latitude, especially in Brazil and Guiana, and is said to be met with also in some parts of Africa.

The body is egg-shaped, broader and only half as large as the human flea, of a brownish red color with a white spot on the back. In its organization it differs but slightly from the other animals of the same family. Pulex penetrans becomes notable only by its mode of life. For while the male strives to reach any accessible mammals so as to obtain its nourishment after the manner of its kind, the fecundated female waits in the sand for such animals as offer sufficient amount of blood during the whole time of ovulation. But man, too, is one of its favorite objects. Children playing in the sand may be attacked by it on any part, while in adults it generally bores into the nail bed of the toes, penetrating to its third abdominal ring. The first bite is hardly felt by the attacked person, only gradually as the insect gorges itself and the sac-like dilated abdomen swells to the size of a pea, the spot becomes ever more painful by the tension thus produced. Meantime the female expels the eggs from the posterior free part of the abdomen, shrinks to its former size, drops off, and dies. Under normal conditions, the lesion which it has caused heals in a few days without medical aid, in the absence of injurious influences. It becomes serious when not kept clean, if many fleas are close together (three hundred) or if, with a view to forcible removal, the insect with its eggs is pressed inwards, because the numerous larvæ present in the skin may subsequently give rise to grave complications. In neglected and stubborn cases there occur not rarely extensive and deep phlegmons running into gangrene, causing partly considerable losses of tissue, partly necessitating amputations at various points ; sometimes even the life of the patient may be seriously jeopardized.

In order to protect one's self from the sand flea, sound shoes should be worn, and the feet be carefully inspected morning and evening. People with sweaty feet are spared by the sand flea. If the flea has attached itself, one must either wait until it falls, or lift it out with a red hot needle so that no eggs remain in the wound. The treatment of the wound is to be managed on general surgical principles.

*f. Tabanidæ, Gadflies.*—Large flies with broad emerald green body and depressed head. Proboscis projecting with six (female) or four (male) stilettoes. Mandibles present only in the female. Generally females infest the larger domestic animals, but inflict upon man also painful injuries.

*g. Culex pipiens. Gnat.*—Proboscis long, projecting, with four stinging-bristles and five-jointed palpi. Only the females sting, during which act they instil a caustic fluid into the wound. They generally spare animals, but prefer to attack man and by their bite cause rather violent itching and the formation of wheals.

In connection herewith should be mentioned some other species of Simulia (C. columbacensis on the lower Danube) and the mosquito (Simul pertinax), especially plentiful in hot regions, which are particularly annoying to strangers.

*h. Hirudinea.*—Leuckart was the first to include the leeches among the parasites. A considerable number of these, at least during some stage (like H. medicinalis, if it is

to reach full sexual maturity), is forced to lead an ectoparasitical mode of life on warm-blooded animals and occasionally also on man.

Altogether there are known thus far some twenty species of leeches which temporarily prey on man. All of them are distinguished by their elongated body tapering at both ends, by their rings (70–90), and by having at the margin of the head a sucking disk and at the posterior pole of the body an abdominal plate. The oral opening is in front and more ventral. It is limited by a projecting screen resembling a sucking disk, and in the so-called oral cavity there are arranged in form of an isosceles triangle three closely adjoining muscular fibres, *i. e.*, maxillary plates, each of which has up to eighty teeth, and resembles a circular saw. Posteriorly follows the pharynx which can be partially protruded, and then the stomach with eleven pair of lateral diverticula.

Sucking is accomplished thus by the leech: The sucking disk situated around the oral cavity is closely applied to the skin, then by lifting it a vacuum is produced which causes a pronounced hyperæmia in the capillary vessels. By a twisting motion with the serrated maxillary plates the wound is inflicted. Then the pharynx pumps the blood into the stomach, and continues to do so until the animal is gorged, when it drops spontaneously. If immediately afterward we rub gently along the body, a part of the blood can be evacuated without any damage to the animal; otherwise its digestion lasts nine to ten months. Besides, observations have been made that leeches have remained alive even two years without taking nourishment.

The parasitic nature of the true leeches has been used for medicinal purposes since the time of Hippocrates. The most suitable is considered to be H. officinalis—the Hungarian leech exported to the whole of Europe—and next in order comes H. medicinalis, the German leech. Besides, on either side of the ocean almost every strip of country has its own leech.

All the leeches of this category inflict upon man wounds which under ordinary conditions are borne without ill effects. But there are Hirudinea which at times attack man in such numbers that, besides the danger of profuse suppuration, there is that of anæmia. Moreover, there are in tropical countries species of leeches which by their poisonous bite inflict wounds endangering life.

### 2. *Animals parasitical in an immature Condition.*

*a. Cysticercus cellulosæ cutis.*—The occurrence of the hydatid of Tænia solium in the subcutaneous connective tissue of man was demonstrated many years ago (Rokitansky). Küchenmeister and Zürn give the proportion of infection of the skin by this Cysticercus as compared with other organs at five per cent, but I believe that this number is too low. A more accurate calculation could properly be made in northern regions, where proportionately more pork is eaten uncorned and half raw, and where, by reason of the more frequent occurrence of Tænia solium, an auto-inoculation with the eggs of the proglottides is more easily effected. To these causative factors is due the fact that in North Germany the presence of this hydatid in the most variable organs has been earlier and more frequently observed than elsewhere.

The cysticercus in the subcutaneous connective tissue usually reaches only the size of a pea, and hence the swellings caused by it have the same dimensions. But some are met with the size of a walnut, and again others below the usual size, about that of a lentil. These variations depend on whether the cysticercus is living, on the size reached by its caudal vesicle, and on the state of the reactive inflammation of the surroundings. When the animal has perished, the connective tissue envelope shrinks to a minimum, and the

palpating fingers will find only a small deep-seated nodule. But if the animal is still living, the eye appreciates either a small roundish or a larger oval tumor covered with normal skin, having a firm elastic feel, and displaceable on the underlying tissues. Judging from the findings thus far, cysticercus of the skin is rarely isoloted, but almost without exception is met with in large numbers. It is most frequent on the back, next on the lateral parts of the trunk, and on the extremities. Often while the old tumors continue, additional ones form for some time. In the beginning they cause no inconvenience, but become painful when they exceed a certain size and are frequently exposed to pressure.

The final result (often after two or three years) of cysticerci of the skin is obliteration, calcification, rarely abscess formation.

Diagnosis.—The recognition of the tumor can occasionally be of considerable importance. Often we shall be enabled thereby to explain other important morbid symptoms (Chiaris, case of cerebral affection). If we bear in mind, as Bergmann emphasizes with justice, that cysticerci are multiple and that each tumor contains only one animal, it will not be difficult to distinguish it from echinococcus of the skin. In syphilitic gumma the skin usually has an altered appearance, cannot easily be lifted in folds, the tumor on an average is larger, and moreover the history will furnish sufficient information for diagnosis in general. Lipoma is characterized by its continued growth, the uneven rough surface, together with the firm feel. Sarcomata and carcinomata occur in older cachectic individuals, enlarge and increase rapidly, are often painful, and never become smaller.

Although it is possible to diagnose cysticerci of the skin by careful examination of the seat of the affection and by exclusion of the tumors occurring in combination, it will be most advisable either to make an exploratory puncture or to extirpate one of the tumors. In the former case the diagnosis will be placed beyond doubt by the hooklets of the scolex head escaping with the serous contents, and in the latter, by the recognition of the animal.

*b. Echinococcus cutis.*—In dermatological works this parasite is nowhere mentioned: although it has thus far been found often enough in the human skin. According to Davaine's report, among 366 cases of echinococcus he has found the latter thirty times in the muscles and the subcutaneous connective tissue. It is said to occur far more frequently in the female sex than in the male. Echinococcus of the skin causes the patient no other disturbances but a disagreeable sensation of heaviness and tension. The parasite usually dies after some length of time (one to two years) and after it has attained larger dimensions; and, while the contents of the vesicles become turbid, fatty, or changed into a pultaceous mass, the connective-tissue envelope undergoes atrophy, calcification. Its superficial seat, the projection without alteration of the skin, the peculiar fluctuation, and the scintillation of the transmitted light materially facilitate the diagnosis. Here, too, exploratory puncture will furnish the best information. If the presence of echinococcus has been determined, extirpation of the tumor will be the most rational procedure for its removal.

*c. Distoma hepaticum. Large liver fluke.*—Küchenmeister and Zürn (l. c.) report on three well authenticated cases (Giesker, Fox, and Carrière) of incapsulated rediæ (embryos with mouth and intestines) of these animals in the subcutaneous connective tissue. According to this source, distoma is said to have been observed in a woman in the neighborhood of Zurich and in two sailors who had formerly lived in tropical countries. The site differed (once each on the lower extremities, the trunk, and the region of the ear), and equally variable were the symptoms. Sometimes continuous pain was

present so that it was thought there was an abscess, and again the enlargement of the tumor was borne without any inconvenience. In all the cases the diagnosis was made *à posteriori*, *i. e.*, by the demonstration of the distoma.

### *d.* FILARIA MEDINENSIS (GMELIN), MEDINA OR GUINEA WORM.

Body filiform cylindrical, with gradually tapering posterior extremity. The male thus far unknown, female yellowish white, 60 to 80 cm. long, 0.5 to 1.7 cm. thick (Leuckart). Small triangular oral opening surrounded by four small papillæ. Within the uterus several (six to eight) millions of embryos measuring 0.6 to 0.7 mm.

The Medina worm occurs endemically in tropical regions, but only in some strips of country (India, Guiana, Egypt, Brazil, etc.). In Europe and elsewhere it is met with in persons who have returned there after infection. Thus far it has been met with most frequently in man and in dogs, through other animals are not exempt. It is found relatively most frequently in the subcutaneous connective tissue of the lower extremities, of the scrotum, back, as well as that of the conjunctiva, under the tongue, in the heart and in the vessels. Pruner has found a worm in a negro under the liver.

In Africa I have had repeated opportunity to see the bubonic affection produced by the filaria in negroes and have learned on inquiry the opinion current there that the animal in marshy regions bores into the lower extremities of barefoot persons. But this statement is opposed by the fact that the worm occurs also on such parts of the skin where it could not penetrate from the ground, and on the other hand it occurs likewise in persons whose feet are always covered. Hence it is most probable that it reaches the stomach and thence the circulation, to be deposited in the connective tissue surrounding the organs or in the subcutaneous connective tissue of the skin. It cannot be definitely decided whether transportation by the negroes, in view of the pronounced localization of the disease in circumscribed districts, regions, etc., plays an equally important rôle.

When the Medina worm has settled at one place and developed to maturity, it aims to reach the surface. The symptoms manifested in such a case are the following: At a circumscribed spot, where the infested person has felt for some months a certain heaviness, the skin bulges out and gradually becomes red, painful, and slight fluctuation is demonstrable. If the process be left to itself, there finally ensues a perforation the size of a millet seed from which the punctiform head of the animal protrudes from time to time. Thenceforth the opening enlarges to the time when the animal with its brood of embryos leaves the inflammatory spot. When this has taken place, the inflammatory symptoms abate, the swelling diminishes, and after a few weeks an irregular cicatrix up to the size of a hazelnut is formed. However, owing to the frequent occurrence of these swellings, the inhabitants and the physicians of these regions are familiar with the symptoms and therefore they generally commence the treatment in time. They endeavor to seize the end of the animal and then with gentle traction they wind it on a wooden rod, taking care lest it break off. Hence when resistance is encountered on traction, the procedure is interrupted, and the rod with the rolled up portion of the worm is left at the opening of the wound, until the removal is finally effected, sometimes after several days. The process, from the immigration to the expulsion of the animal, may last from six to eighteen months. At times one person may harbor several animals, in which case the process may last two years.

*e. Filaria Sanguinis Hominis.*—According to Lewis and Cobbold, the sexually

mature female is yellowish white, 8 to 10 cm. long and 0.3 cm. broad. The male is half that size. Head rounded, oral opening circular, without papillæ. Posterior extremity of the body pointed, with anal opening. Uterine tubes filled with numerous eggs measuring 12 to 30 micromillimetres. Hatched embryos 0.2 to 0.3 mm. long.

Wucherer (1866), in Brazil, first had his attention directed to this filaria, having found in the urine of a hæmaturic patient active "worms" (embryos) of a "species hitherto not described." Subsequently the same embryos were discovered in chylous urine. In 1872, Lewis succeeded in finding the filaria in this early stage in the blood, and in the tissue juices. And as the persons infested with them suffered at the same time either from chyluria, or from elephantiasis arabum, or from lymphectasia of the scrotum, he began to suspect that the affections named might bear a causal relation to the occurrence of the parasite. This supposition gained in probability when Cobbold (1877) was enabled to report, through communications by Bancroft, that he had found in Australia, in a lymphatic abscess of the arm one filaria, and soon after in a hydrocele of the spermatic cord four sexually mature filariæ. In the same year, too, Lewis discovered a mature worm in the blood coagulum of an Indian (Bengal) operated on for elephantiasis scroti, so too Silva Aranjo (in hæmaturia) and Santos (in lymphatic abscess on the arm).

To Manson belongs the merit of having discovered that the filaria embryos are taken from the human blood into the body of the female mosquito, where they undergo their development, and by the death of the mosquitoes in stagnant and marshy water are set free as mature filariæ. Manson assumes moreover that with the ingestion of such water the mature animals get into the human organism, and by reason of the inflammation and obliteration they cause in the lymphatic channels and organs, according to the locality, give rise to either elephantiasis arabum, chyluria, chylous hydrocele or other related affections. Only isolated voices (Tilb. Fox, Genet) have been raised against this view. In reply to these, Manson (1881) has demonstrated in a case of elephantiasis nævoid. scroti that from the absence of the filaria embryos in the blood, the diminution of the lymph corpuscles in the vessels, and the presence of embryos in the chylous fluid, we may conclude with good reason that it is the mature filariæ which cause the obliteration in the lymph channels around the glands (inguinal). From the numerous investigations carried out with great perseverance and ingenuity, he even goes so far in his deduction as to trace to the same cause, besides the lactifluous form, also the ordinary typical elephantiasis arabum of the tropics which commence with affection of the lymph-vessels and intermittent fever.

Although these deductions cannot be accepted in their totality, it must always be recognized that Manson, Lewis, and others were the first to point out that there is a causal connection between the presence of filaria sanguinis hominis and a number of cases of endemic elephantiasis, chyluria, etc.

*f. Craw-craw.*—Within the last few years, some cases of cutaneous disease have become known which, by reason of the microscopic results obtained, show undoubtedly that they are caused by nematodes.

O. Neill,[1] in 1875, observed in negroes on the west coast of Africa a papulo-vesiculo-pustular eruption, called craw-craw by the natives, which made upon him the impression of an old scabies, owing to the violent itching and the localization of the efflorescences (fingers and extensor sides of the forearm). Hence he was not a little surprised to discover in the scraped epidermis covering the nodules, and in the sero-purulent fluid ex-

[1] Lancet, 1875, No. 20, February, with Illustrations.

pressed from the depth, several actively moving worms, 0.2 mm. long and 0.01 mm. broad, which in their appearance were said to be filaria. Two years later, Silva Aranjo in Brazil treated a case of craw-craw associated with chyluria and elephantiasis arabum. S. Aranjo states that he has found embryos and one mature filaria (dead) in the urine and in the lactiform fluid, but makes no mention of any discovery in the skin.

Although at first we would feel inclined to accept for both craw-craw affections some kind of filaria as the incitor of the disease, we shall hesitate when we bear in mind that Nielly[1] (1882) had an opportunity of observing in Brest a fourteen-year-old boy who had never been outside of the limits of France, with completely analogous morbid symptoms, and here, too, scabies was at first suspected. Nielly has found in the contents of the vesiculo-pustular efflorescences several nematodes, up to 0.333 mm. long and 0.13 mm. broad, even sexually mature females. He is inclined to consider them one of the numerous species of the genus Leptodera, fam. Anguillulidæ, but thinks that he cannot fully disprove the view (Corre) that they are a kind of filaria.

In my opinion, Nielly's statements, especially the occurrence of the disease in France, the natural-historical description of the fully developed, sexually mature animals, and the complete cure of the patient after some baths, as well as the fact that these anguillulæ in general have a particular predilection for a parasitical life on the skin, make it appear very probable that both here and in the cases mentioned by O. Neill a species of leptodera (the animal having really not been examined at all) has produced the cutaneous disease, and this, moreover, under the influence of external circumstances.

*g. Oxyuris vermicularis.*—The mature female is 10 mm. long, the male only half that size. The posterior part of the body of the female is like an awl, that of the male tumid. This worm lives only in the intestinal tract, and inhabits the various portions of it, commencing with the stomach (in the shape of ova), according to its phase of development. The fecundated female always keeps beyond the cæcum, and in proportion as the time for oviposition approaches, descends as far as the rectum. The eggs are deposited usually in the fæces, but it happens, too, that the female slips out of the anal opening, causing violent itching, and then lays the eggs in the neighborhood of the anus. In a boy aged thirteen who suffered from oxyuris vermicularis and was affected with a neglected eczema intertrigo on the genito-crural folds, Michelson found on the scraped epidermis eggs containing tadpole-like embryos, 0.05 mm. long and 0.016 mm. broad, as well as hatched embryos of the extended form. He correctly explains the cause of this interesting discovery by stating that the boy had himself effected the transmission to the eczematous spots through the shirt-tail soiled with the fæces.

*h. The Larvæ of Diptera.*—Even to-day we are unable to name all the larvæ living parasitically on man. But in the extensive families of muscidæ and œstridæ there is hardly any species whose larvæ have not been found in wounds and injuries. However, the animals effect an entrance in various ways, and the manner in which they reach the wounds depends rather on the characters of the families and species.

*α.* A considerable part of the muscidæ (flesh, house, stable, dung, and other flies) possess defective maxillæ and a proboscis with fleshy end lobes. These insects, therefore, are unable to injure the skin, and are forced to nourish themselves with the secretions, etc. In the same way, their larvæ (maggots) have only rudimentary oral apparatus. Consequently, the pregnant females seek to place their eggs and larvæ in situations where they easily find the conditions for their future development. Among these must be in-

[1] Gazette Hebdomad., 1882, Nos. 15 and 18, pp. 244 and 298.

cluded neglected wounds. The hospital physician not rarely has the opportunity of seeing a number of them in wounds, for instance, of the scalp. The impression obtained hereby from the active motions of the animals is peculiar and at the same time disquieting. It is obvious that considerable diffuse irritative conditions of the skin, increase of the inflammation, with resulting erysipelas and phlegmons, may ensue under these circumstances.

Altogether different is the procedure of those œstridæ (Dermatobia noxalis, Cuterebra, and Hypoderma) and muscidæ (Lucilia Cæsar in America, Stominis calcitrans in Africa, Sarcophila Wohlfarti in Russia, etc.) which place their ova or larvæ under the skin by means of their stinging apparatus. Although they also use raw surfaces for this purpose, they employ their implements with equal frequency for inflicting fresh wounds. In this way are produced those frequently very painful furuncular inflammations which continue until the larvæ escape. At times these tumors even undergo suppuration and gangrenous disintegration which may lead to loss of the limb, etc.

But it is not necessary that the mother animal itself should always bring its offspring under the skin. Sometimes the hatched larva works its way unaided from the epidermis into the various depths of the skin. Thus, for instance, it is known of the larvæ of the genus Hypoderma that the thread-like body bores into the opening of the follicle and thence advances into the cutis, causing various forms of destruction.

## III. ACCIDENTAL PARASITES.

Dermatodectes (Gerlach), Psoroptes (Gervais), Dermatokoptes (Fürstenberg), and Symbiotes or Chorioptes Dermatophagus. Both species of mites are larger than those of sarcoptes, but are of the same shape. These mites are characterized by the scissor-shaped maxillary palpi and the long legs. The male of Dermatodectes has at the ends of the legs pedunculated sucking disks, the female long bristles on the fourth pair of feet. Symbiotes possesses inflated-looking sucking disks on short stems, and thicker but shorter maxillæ. Dermatodectes burrows as far as the cutis, while Symbiotes remains on the corneous layer.

The mites of Dermatodectes and Symbiotes are unable to maintain themselves permanently in the skin, but perish in from three to five days. They cause by their presence an eczema in the form of nodules and pustules and are easily found after scraping the dried contents, *i. e.*, the crusts.

*Leptus autumnalis. Harvest bug.*—It is not certain thus far whether it is the six-legged larva of Trombidium holosericum (Hermann)—the common red earth mite—or that of Tetranychus. But at all events it belongs to the family of the Trombidæ. Normally its body is oval (with Hartn. eye-piece II., obj. VII.) 0.35–58 mm. long and 0.32 mm. broad, and is divided on the ventral surface into cephalothorax and abdomen by a transverse furrow. The oral parts consist of a short conico-cylindrical, retractible sucking proboscis which is formed by a fusion of two maxillæ. Laterally from this are two strong, five-jointed palpi which can be rolled up and bear powerful hooked claws. Two large hatchet-like mandibles moreover assist the function of the proboscis. On the surface of the cephalothorax is a cuirass-like shield which bears two stigmata guarded by bristles and laterally from these two simple eyes. On the lower surface are the triangular epimeres with three pair of legs. Each of the latter is six-jointed and has two claws on the tarsus. The abdomen is large, broad, and slightly striped. Sexual parts have not been found thus far in Leptus.

Symptoms and Course.—In the hot season, especially during July and August, we not rarely have occasion to observe the occurrence of an eruption associated with violent itching in persons who are around gooseberry, elder, and other bushes. The affected skin, owing to the scratching, looks diffusely red and has on its surface a considerable number of bright-red nodules and wheals up to the size of a pin's head. Sometimes the affection spreads from the parts first involved over the greater portion of the body. In more intense cases a slight febrile movement is generally associated with it.

If we inspect the several efflorescences more closely, we can almost without exception

Fig. 56.—Leptus autumnalis (harvest bug).

Fig. 57.

perceive near its centre a slight elevation which is conspicuous by its yellowish red color. When we seek to lift it off with the point of a needle or to scrape it away, we can often see with the naked eye an actively moving reddish animalcule.

Treatment.—The nature of the affection having been ascertained, it is the first duty of the physician to search for the source of the transmission so as to guard against further invasions. In such a case, then, as the mites do not increase and soon perish, the process barely lasts a few days; while otherwise diseases of several weeks' duration may occur.

*Kriptoptes monunguiculosis* (Acarus hordei) is the name I have given to the larva of a mite which is rather frequent in barley and is apt to annoy the mowers, the laborers occupied with loading, etc. The creature is of an oblong oval form, yellowish white color, and on the average 0.022 mm. long (Fig. 57). The oral parts consist of a protrudible tubular boring apparatus which is inclosed by serrated mandibles. On each side of this are the five jointed palpi. There are four pair of feet, two on the cephalothorax and two on the abdomen, which are articulated to the epimeres. The tarsus of the first pair of feet terminates in a hooked claw, while the other three bear sucking disks on stems. Between the first and the second pair of feet are the oval swinging clubs which indicate the larval condition. The tracheal system clearly developed. Sexual parts entirely absent.

The slightest cutaneous disease caused by the larvæ consists in an eruption of urticaria. The efflorescences show a special tendency to locate around the mouths of the follicles. If we carefully try to lift the epidermis in the neighborhood of the mouths of the follicles, the animalcules are almost without exception found beneath. Where the skin is sensitive and the irritation intense we observe a rapid transition of the urticarial eruption into a very itchy eczema, and a painful dermatitis. In such a case the skin becomes bright red, its temperature increases, and sometimes slight febrile movement is present. The inflammatory symptoms of the skin having reached their height after three or four days, and no fresh causes being superadded, they remain stationary for a short time, and then involution ensues, scratch effects and pigment spots being left behind.

*Clothilia inquilina.*—Under the heading "Eine Invasion von Holzläusen" Virchow[1] reports that the teacher at Parstein near Oderberg in Neumark was much annoyed by the appearance of an insect which spread from the living rooms over all the objects, clothing, etc., that were in them. Gestäcker states that it was an orthopter from the family Psocidæ, book-lice, the Clothilia inquilina of Heyden.

[1] Archiv für pathol. Anatomie und Physiologie, Bd. 54, p. 283.

# THE NEW-FORMATIONS OF THE SKIN.

BY

PROF. E. SCHWIMMER, AND V. BABES, M.D.

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## INTRODUCTION.

BY

VICTOR BABES, M.D.

THE new-formations of the skin comprise those circumscribed, usually tumor-like structures which arise in the manner of embryonal organization; certain cells dividing and differentiating according to the same laws as those manifested in the formation of the tissues and organs of the body.

Especially during the process of division the cell manifests itself as a complicated organism, there being unfolded in it a plan-like plot of threads formed from the nuclear substance which in the first place leads to a strict partition of every formed nuclear portion. In the same way, the fecundated ovum likewise divides; portions of the parental organism are appropriated to each embryonal cell, and thus its qualities become hereditary in the offspring.

The organism would become normal if external influences or the heredity of abnormalities which originally come from without did not disturb its development. External conditions will modify the course of the cell more or less; there arise abnormalities which in part are probably equalized, eliminated, or made subservient to the purposes of the organism, but in part may endow the further development of the organism and its offspring with noxious peculiarities.

Thus we can artificially produce abnormalities which become hereditary (Brown-Séquard) and give rise to malformations by artificial influences on ovum and embryo (Dareste, Gerlach).

According to these reflections, we are justified in assuming that tumors likewise originally owe their existence to external influences, of the nature of which, however, only hypotheses are in our possession.

We can assert positively only that tumors may form in every stage of development or of retrogression of the organism, and that often the causative factors are laid by the parents in the plan of the new organism, which not rarely may remain hidden until the appearance of the tumor. Finally we must assume that in intra-uterine or extra-ute-

rine life external injurious influences may also create similar factors which manifest themselves subsequently as tumors, generally again through some external agency.

Such factors have also been called tumor germs, and this designation has been applied to the conception of a latent embryonal tissue; I shall apply the term tumor germ, or better, tendency to tumors, only to that material which is associated with arrangements by reason of which tumors arise at any time, from any cause.

Such tendencies to tumors might be: disposition to abnormal direction of growth; redundant or misplaced tissue material (Virchow, Waldeyer, Cohnheim, and others); a disproportion of the energy of growth of different tissues (Boll); a peculiar vascular arrangement; a diffuse or circumscribed evil power of proliferation of many tissues, etc. The more immediate cause of the formation of tumors, then, lies in external irritations, in trauma, cicatricical formation, perhaps also in a relaxation of the physiological power of resistance of the organism.

Besides these tumors, there are also some in which, after the external, generally intense disturbances, true tumor formation follows closely on the immediate reactive symptoms.

Only one thing seems to distinguish this form of tumor from those of early tendency. Namely, the longer an abnormality, for instance a tendency to tumor, remains latent in the plan of the organization (as a hereditary tendency) the more its manifestation seems to have adapted itself to the form of the normal development of tissues and organs. But in every case the tumor, whenever it undergoes development, precisely by reason of its present independence, will deviate from the laws of normal organization as a branch does from a trunk.

The external skin is first exposed in a high degree to such injurious influences as stimulate it to new-formation; then there will be a disposition to tumor formation at those places where in embryonal life it is easiest for a displacement, a malposition, or a retention of certain tissues in a state of proliferation to occur, as at the transition of the skin into mucous membrane, where different kinds of tissue become intimately united, at points where embryonal openings have closed. Then we often find accumulated by heredity abnormal tissue which persists in an earlier stage of development for some time or permanently (for instance, warts). Usually, however, it is again external causes which incite such places to excessive proliferation, to independent organization, to the formation of tumors.

But it cannot be denied that certain external influences likewise incite the skin to similar formations without previous disposition.

In most tumors, several of these etiological factors obviously concur.

Particularly in the explanation of the diffuse and the multiple tumors we cannot advise against the assumption of a congenital disposition to the progressive formation of a certain species of tissue. Obviously in these cases there is in the region of certain differentiated formations of the skin an abnormal arrangement by means of which tissue material accumulates locally, or rather tissue capable of proliferation which grows in such a manner as if it were to build new normal tissue. Thus for instance the epidermis, the papillæ, the glands and follicles, the cutis, the adipose tissue form general hypertrophies; while the sheaths of the glands, of the nerves, of the vessels, of the muscles, the vessels themselves or their rudiments, singly or in combination, may be the field for multiple processes of growth.

In order to explain metastases—emboli of tumors and their proliferation, then, infection by fluids, by molecular portions of cells or sprouts, have been made to do service,

but this latter assumption cannot be brought into harmony with our experience in the formation of cells. In this case, too, we can hardly deny that the formation of metastases is often nothing but the manifestation of the multiple tendency to tumors which was incited in the first instance by the irritation of a place locally predisposed somehow to the formation of tumors (primary tumor). It is probable for this reason that multiple tumors pass without sharp limitation into those forming metastases, and their differences lie mainly in the benignancy of the former, and the malignancy of the latter.

The tumors of the skin have been differentiated from very widely divergent standpoints, but in general we can assert that the finer tissue differences and localizations of tumor formation were neglected until the most recent times. Pathologists again looked upon tumors of the skin from their systems, without appreciating their peculiarities. But meantime it had been demonstrated by many investigators that the individual constituents composing the skin undergo new-formation separately and from various causes, and that the tumors thus varying in their nature correspond likewise to the clinical differentiation.

However, investigators also went too far in this analysis; they grouped, for instance, the well-known connective tissue tumors deliberately according to one portion of tissue chiefly implicated.

Therefore, in the following pages we shall, while considering the place of origin, bear in mind the insufficiency of every system, with due regard to the infinite multiplicity of the forms and transitions. In general, we must not lose sight here of the fact that the new-formations usually spring from one of the larger tissue germs, either the archiblast—that is, from the primitive trace of the embryo itself—or from the parablast growing from without inwards.

In the first place, we shall discuss the tumors of the parablast—that is, the tissue appertaining together, having its rudiment in the germinal welt[1] and forming the vessels and the connective tissue, which extends into the embryonal trace, where it forms vessels, deposits, and envelopes of connective tissue, and differentiates into endothelium, lymph-cells, and blood-cells.

These tumors develop, according to the formative laws of the parablast, in the direction of vessel and connective tissue formation. The parablast portion of the skin forms first a thin, dense, almost structureless and non-vascular subepithelial stratum pierced by nerve-fibres and lymph-spaces which enter into the rete Malpighii. The succeeding stratum forming the papillæ is close-meshed, lax, with wide lymph-spaces and a uniformly distributed, nearly independent vascular arrangement and elastic substratum. The stratum areolare is indistinct, with loose fibres, juicier and richer in cells, containing embryonal elements. Within it extend the deep vascular network and independent vascular arrangements for follicles and glands. Then follow coarse-fibred, wavy layers, with larger vessels and nerves embedded together in loose tissue. Finally, there follow fat-columns, with separate vascular apparatus, and between these a firm tissue in which run the vascular connections of the skin with the interior of the body. Lastly, the parablast furnishes envelopes for follicles, glands, nerves, and muscles of the skin. From each of them new-formations may arise; but in most tumors several of these differentiated constituents participate.

[1] Recent investigations, especially those of Waldeyer, have shown that in all ova we can distinguish two rudiments, one of which comprises the first furrowed portion rich in protoplasm (archiblast), while the other encompasses the adjoining elements, poor in protoplasm, but rich in nutritive material, which become furrowed later and extend into the archiblast (parablast).

Thus there are uniformly derived from the entire parablast: certain forms of pachydermia, of ichthyosis, of sclerema, of elephantiasis, the cicatrices. Mainly connected with the papillæ are: papilloma, some chronic inflammatory new-formations, condyloma acuminatum, polypapilloma tropicum; from tropho-nervous irritations there arise here: the neuro-papilloma and similar more ichthyotic forms.

Connected with the sheaths of the nerves, vessels, and glands as their true new-formations are: many hard, but especially soft fibromata; also some forms of lepra and elephantiasis mollis. The wall of the vein is chiefly implicated in rhinoscleroma (in chancre, in small-pox, in erysipelas—Recklinghausen). Cellular proliferation, with new-formation of blood-vessel walls, is generally found pronounced in syphiloma; hyaline degeneration of these parts, in cylindroma. Hyperplasia of the arterial wall is especially marked in some racemose angiomas, in scleroses, and in rhinoscleroma.

In certain vascular districts, congestion, especially in an early period of development, may incite not only œdema and vascular dilatation, but also new-formation.

More immediate causes of these are given in local abnormalities of the vascular system and its innervation, in some cases perhaps also in an hypertrophy of the muscular structures of the skin. These factors come into the foreground in myxoma (Köster) and lipoma, in xanthoma, in cases of elephantiasis lymphangiectatica, of pachydermia œdematosa, and of sarcomphalus.

New-formation with dilatation or infiltration of plasmatic channels of the cutaneous framework and the sheaths are found extensively (in acute inflammatory tumors) in tubercle, in lupus (around sebaceous follicles), in elephantiasis arabum, in xanthelasma (as new-formation and peculiar fatty degeneration of the endothelia), as well as in many fibromas and sarcomas.

New-formation of tendinous, elastic, hyalin tissue of the cutaneous framework is found chiefly: diffusely in scleroma; circumscribed, scar-like in keloid, in scleroses, in rhinoscleroma.

From the embryonal proliferative material, especially from rudiments of vessels at any point of the connective tissue of the skin proceed:

1. As new-formation of endothelia—soft uncolored or pigmented moles and warts (Recklinghausen). From these or primarily endothelial sarcomata arise. Endothelial proliferation also plays an important part in many (infectious tumors) angiomata and sarcomata, in xanthoma.

2. Sarcoma, with persistence in an embryonal stage and degeneration of the rudimentary vessels.

3. Most melanotic tumors with pigment degeneration of rudimentary vessels.

4. Angiomata advancing to excessive formation of vessels, or even superseding this process (as angioma cavernosum).

Finally there are developed in the skin, parablastic tumors which owe their origin to none of the normal constituents of the skin, which we must therefore ascribe to misplaced germs or to the formation of abnormal tissue in the skin. Among these belong—enchondromata, osteomata, lymphatic tumors.

# CONNECTIVE TISSUE NEW-FORMATIONS.

BY

PROF. ERNST SCHWIMMER, M.D.

(Histological Part by V. BABES, M.D.)

## 1. THE CICATRICES OF THE SKIN.

Kinds of Cicatrices and their Production.—We apply the word cicatrices to those new-formations of dense or firm texture which develop in place of the losses of substance due to destruction of the skin and its papillary layers; they usually show a smooth, more or less glossy surface of white color, but when traversed by fine blood-vessels, the surface appears slightly reddened or pink. The epidermis of the cicatrix, in recent cases, is smoother than the normal surroundings owing to the obliteration of the efferent ducts of the glands and here and there also of the hair-follicles; when the cicatrix is older, its surface appears slightly glossy, here and there somewhat scaly, but in it, too, there is an absence of the well-known undulating lines and stripes corresponding to the papillary elevations of the cutis, for there is no reproduction of the papillæ when the skin is destroyed to some depth. Now and then observers have assumed a new-formation of the papillary body during cicatrization, but these structures are formations of tissue consisting merely of vascular loops resembling the papillary body, but containing no tactile papillæ (O. Weber).

Sometimes the cicatrices are at the same level as the rest of the skin; these are called flat cicatrices: sometimes they rise above the surface of the skin and form oblong or roundish thicker masses of tissue; they are then called hypertrophic: or when they lie below the level of the general integument in the shape of depressed or shrunken portions of tissue, atrophic cicatrices. When firmly united with the substratum and extending beyond the underlying connective tissue as far as the periosteum and the bone, the cicatrix is called fixed or adherent; but if it is freely movable, it is called a free or movable cicatrix.

The development of cicatricial tissue presupposes some essential lesion of portions of the skin; wherever the proliferating power of the skin is excessively augmented after breaches of continuity and losses of substance—*e. g.*, in consequence of some injury destroying the skin—repair of the loss of substance occurs. We observe the same wherever there has been inflammation with subsequent disintegration of the more plentifully

accumulated formative and nutritive material; in all the cases named, the embryonal tissue serving for the maintenance of the normal, and now for the regeneration of the lost substance, is, with its vessels, drawn upon for the repair, in which process the moderate irritation of the present inflammation and the absence of the physiological resistance represent multiple factors favoring the restoration.

This repair, after losses of substance, is by no means effected uniformly; it is determined by the healing process through which the new-formation is completed in a shorter or longer time. For this reason, the healing of the lost normal tissue has been classed according to various degrees depending on the preceding lesion and the duration of the repair, respectively a healing per primam, per secundam, and per tertiam intentionem. The cicatricial formation will accordingly differ.

*Healing by first intention, i. e.*, rapidly ensuing cicatrization, is usually found after sharp divisions of continuity; there the wound-margins readily coapt, the severed connective tissue is joined by new cell-proliferation and vascular twigs, there is no suppuration, and a rapid cicatrization without material reaction in the injured tissue. Thiersch demonstrated by correct investigations that the intermediate substance which causes cicatrization by first intention is the inflammatorily infiltrated connective tissue of the wound-surface itself.[1] In this mode of healing, which ends within a short time (twenty-four to forty-eight hours), the cicatrix itself is quite unimportant, as there are no inflammatory conditions.

*Healing by second intention* is healing with inflammatory process. Where injury of the skin destroys a larger quantity of normal tissue, the loss of substance is filled up after some time by means of new-formed tissue—from the vessels, which have become embryonal, of the surrounding points grow mutually anastomosing buds (granulations), which are enveloped by a tunic of round cells (leucocytes), as well as fluid and coagulated exudation. This young tissue, however, seems to contribute but little to the permanent filling; it disintegrates superficially into a purulent layer, the pyogenic membrane, which by degrees is floated away as pus (Thiersch), while the underlying layer, which carries plasma, fills with numerous cells and blood-vessels of new-formation. In the depth this tissue changes into a new-forming embryonal layer, consisting of stellate and spindle cells and a dense network of recent vessels. Gradually the latter contracts more or less irregularly, becomes poorer in plasma, dense and fibrous; the wound-surfaces appear redder and uneven by the plainly developed granulations. At the same time, approximation of the wound-surfaces is effected also by the epithelium; while the mass of granulations seems to project above the level of the skin, the epithelium is ever farther advanced from the lateral edges of the skin, the pyogenic layer yields under the progressing tendency to heal, the connective tissue develops more and more, and after a certain lapse of time, the epithelial layer will appear as an epidermis layer without papillæ, without hairs, and without glands, whereby the former surface of the loss of substance is completely covered and becomes perceptible as a cicatricial formation.

*Healing by third intention* is merely a healing process somewhet increased over the preceding as regards duration and extent of the cicatrization. The cicatricial formation depends on manifold factors which have great influence on the manner in which the loss of substance is replaced. After extensive destruction of the skin, deep suppuration, and in conditions with weak or bad tendency to recovery, as in cachexiæ, tuberculous, syphilitic, or scrofulous diseases, the cicatricial process is effected slowly and incompletely.

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[1] Pitha-Billroth: "Allgemeine und specielle Chirurgie," i., 2. Abtheilung, B, p. 540 et seq.

While, in cases where the deeper layers of the rete Malpighii are preserved, the cicatrization is rather rapid and the new-formed tissue shows a softer consistence; in the last-named conditions, which generally destroy the cutis tissue to a greater extent, the granulations are less firm, develop very imperfectly, are smooth, dry, hemorrhagic, and show a slighter tendency to adhesion; at times again they exhibit the opposite state, appear succulent, hydropic, possess little power of resistance, and disintegrate readily. If the sweat glands have not perished, the skinning over is more rapid and better, and Schroen has found, in the new-formed layers of epidermis, wherever the latter were preserved, always a newly-formed stratum Malpighii. A disturbing influence on the cicatricial process is also exerted by local conditions, such as pressure and traction, uncleanliness, especially bacteria and mould fungi, which are deposited in the granulation, and are often followed by necrosis of the young tissue, as well as its diphtheritic degeneration, and thus may also give rise to general infection.

However, the individual constitution often causes also an excessive proliferative power of the tissues, as in persons with tendencies to multiple tumors; in them, after losses of substance, we usually see the granulations in the new-formed tissue develop to an extraordinary size (caro luxurians), so that the tendency to cicatricial formation is completely destroyed; we then find proliferation which is out of all proportion to the insignificance of the loss of substance. A tissue thus newly formed is changed pathologically while still in its proliferating stage and may undergo tuberculous, sarcomatous, carcinomatous degeneration; but if cicatrization occurs before after-formations have formed, there are generally developed from these cicatrices densely fibrous tumors such as keloid, or malignant neoplasms such as carcinomata, or sclerotic tumors such as sarcomata.

Quality of the Cicatrices.—According to what has been stated, the cicatricial formation is influenced partly by internal, partly by external factors, and it is not always possible to recognize from the cicatrix the injury which has preceded it. Nevertheless there are several landmarks which permit the recognition of the cicatricial formation. Most readily determined are some diseases such as syphilis and scrofulosis, the former by the characteristic, horse-shoe-shaped; the latter by peripherally extending, uneven, often tumid cicatrices; but even here mistakes are easily made. Often the seat of the cicatrix offers a guiding point for determining the former morbid process; a deeply depressed cicatrix above the zygoma or in the region of tubular bones permits the conclusion that particles of bone have been lost; but whether the pathological process was caused by a trauma or by scrofulosis is at times beyond the possibility of being determined; a cicatrix on the glans penis or in the inguinal region will permit the recognition of the causative disease without difficulty; stellate cicatrices with contraction of the adjoining portions of skin, or glossy, dark red, gradually fading cicatrices allow the conclusions that the skin had been burnt or cauterized. Such guiding points may be taken into consideration, but we must beware in a concrete case of making a positive diagnosis.

The dermatonoses which run their course only with a slow suppurative process—*e. g.*, serpiginous lupus, ulcerous syphilide, superficial carcinoma, a prolonged zoster ending in suppuration, etc.—bear the same relation to the characteristic cicatrization as do other morbid processes.

Symtoms of the Cicatrices.—The completed cicatrix is at first dark red by reason of the abundance of vessels, gradually the cutaneous surface will become paler from the obliteration of the recent vessels, and its color will become whitish or approach the normal tint of the skin. The healing process itself is at times associated

with certain subjective symptoms. In normal cicatrization the healing of the loss of substance may proceed without incident and rather rapidly; the new-formed tissue, containing blood-vessels in large number, shows a great tendency to hemorrhages, after external irritations such as pressure, knocks, and blows, but as a rule they seldom reach a high degree and cease spontaneously. Nerve elements, which are numerous in the young tissue, explain to some extent the more or less great sensibility of the skin, but during the healing stage there is no material increase in the irritability or painfulness. Greater sensibility is almost invariably present in the young tissue as long as the granulations lack the protecting covering; sometimes this is manifested as itching. In fact, the itching is found wherever there is a tendency to rapid skinning over, but often also in badly granulating formations of tissue with a tendency to disintegration.

Some patients now and then are unable to resist the irritation and destroy the granulations by rubbing or pressure; thereby the healing process is perhaps somewhat retarded, but the final cicatrization is not limited on that account. When the skinning over has been completed, we sometimes find some tension in the recently formed skin, and according to its location some restriction to its free mobility; but these irregularities in the young tissue are gradually equalized, and the occasional tumefaction, as after large burns, carbuncle, etc., flattens. But if the cicatrization has been effected with preceding firm adhesion of the soft parts, and if healing has taken place only by connection of physiologically separated parts of organs (fingers, extremities, nucha), the cicatrization has produced a lasting deformity.

Treatment.—Often the healing process is rendered difficult partly by the locality in which the loss of substance occurred, partly by other pathological factors inherent in the affected person, and here it is necessary to remove these disturbances. This is done by the most thorough possible cleansing of the wound surfaces, keeping off all disease-producing and septic substances, and removal of all disturbances to the circulation in the neighborhood of the raw surfaces. The immediate consequence is that the new granulations are better developed and that the healing tendency is accelerated. In former times it was customary to attain this desired object by various ointments and plasters, but such remedies are now obsolete, inasmuch as the former treatment has been altogether displaced by the antiseptic method. Where the formation of granulations is lax, irritating agents can still be employed, such as copper sulphate (0.05 to 0.10 : 10 to 20 gms.), both in form of ointments or in solution; also silver nitrate (0.1 to 0.5 : 10 of petrolatum); and either one of these in a more concentrated form as caustic, the copper in 1 to 10 per cent, the silver in 50 per cent solution. In syphilitic or scrofulous ulcers these remedies occasionally do more than the pure antiseptics. Where the wound surfaces show a tendency to diphtheritic disintegration, iodoform, best in powder, may be employed; this drug, by restricting suppuration, gives the best results, only its odor prevents its general use. In gangrenous ulcers, camphor solutions (Camphor. subactæ, 0.5 : Mucil. acaciæ, 150), charcoal powder, tarred gypsum (Bitumen fagi or oleum cadini 10 to 15 : Calcaria sulphur. subt. pulv. 200) should be applied to the surface of the sore and changed once or twice daily.

Among antiseptic agents carbolic acid stands first, on account of its general applicability; it is used in aqueous (1 to 5 per cent) and in oily (glycerin, olive oil, 5 to 20 per cent) solution. Surgical therapeutics have made the antiseptics very serviceable by combining them with the dressing material such as gauze, cotton, and jute (the bast fibre prepared from Corchoris capsularis) with which the wound surfaces are dressed after each cleaning. Besides carbolic acid are used: salicylic acid (best as salicylate of sodium in 3 to 5 per cent solution), thymol (1; alcohol and gly-

cerin, ana 25; Aq. dest., 1,000), and boric acid (10 to 20; Ol. oliv., Glycerin, ana 40; Ungent. emollientis, 100). Of more limited application are: zinc chloride, sodium subsulphate, kaolin (alumina acetica), eucalyptus oil, etc. Recent investigators have shown that corrosive sublimate claims the first rank as regards antiseptic and antibacterial effect, but owing to its associated toxic qualities it is not liable to find extensive employment even in the general treatment of wounds.

With very large and sluggish ulcerous surfaces, especially those of the leg due to and maintained by varicosities, we sometimes observe that cicatrization will not take place in spite of rest, cleanliness, and therapeutic measures; for these the process of transplantation recommended by Reverdin is applicable. It is as follows: From a healthy portion of the skin of the patient, best from the extremities, pieces the size of a hemp-seed to that of a lentil are excised down to the subcutaneous tissue, and according to its extent placed at equal intervals upon the ulcerating surface which must have been thoroughly cleansed. The entire portion is then bandaged with strips of adhesive plaster which are removed after from three to six days, when the ulcerating surface is again treated antiseptically. When the transplantation has succeeded, we find the several grafted pieces of skin as an equal number of small islands of new formation which cause the development around them of new tissue and are gradually followed by the junction of the isolated patches. Where there is excessive granulation with masses of tissue projecting above the level of the surroundings, the redundancies must be removed or destroyed, which is best done with the stick of lunar caustic, and repeated until a normal proliferating surface is secured which is then treated according to some one of the methods described.

The completed cicatrices are occasionally very firm and tense and form, partly by their tumid appearance, partly by their shape, disfigurements the removal of which is often sought by the patient. Operative interference is to be recommended only in those cases where we find sufficient cutaneous tissue to permit of the complet eexcision of the cicatrix, after which the margins of the wound are to be united as in scrofulous cicatrices with puckered surroundings; but generally surgical procedures fail, for where the neighboring tissue is tense, the condition can only be made worse. In certain cases improvement of the cicatricial cutaneous tissue is demanded for cosmetic reasons, *e. g.*, after small-pox or local inflammatory processes in the face. Now and then satisfactory results are attained by long-continued cauterization with lunar caustic or painting with tincture of iodine which produce a reactive inflammation, and thereby a detachment of small layers of the skin. We can secure an improvement of the surface of the cicatrix, but not a total restitution of the skin.

## 2. KELOID (CHELOID, CHELIS).

Symptoms.—This new-formation bears a strong resemblance to the hypertrophic cicatrix, but is an affection of spontaneous origin and not to be considered as a restitution of lost tissue after ulcerous processes or losses of substance.

Keloid appears as a new-formation which sometimes projects above the level of the skin, sometimes lies rather flat within it, either as an oblong plane or elevated ridge, or as a cylindrical thickened mass with processes extending into the surroundings. The color of the keloid is rather whitish, sometimess lightly reddened, the surface smooth, rarely covered with hairs, the epidermis tense and but seldom to be lifted with the cutis from the substratum. The development of keloid cannot always be closely followed; usually it arises from one or several nodules which after having persisted months or years, coalesce and form a single structure. The concomitant symptoms manifest themselves sometimes in a more or less intense itching and in greater sensibility on pressure, at times even

painfulness. The site of the keloid is usually the trunk and the sternal region, but it occurs also on the nucha, back, and the extremities. The new-formation is permanent, but I have also observed spontaneous retrogression.

Alibert distinguished two forms of keloid; the one he called the true keloid or the idiopathic form, as opposed to the other, *i. e.*, the hyperplastic formation from cicatrices which he named the false keloid.

The more modern histologists and clinicians have finally accepted the division made by Dieberg[1] which, besides the varieties of keloid named, contains a third, namely, the verrucose cicatricial tumor.

In close connection with the symptoms of keloid is its DIAGNOSIS, for we often encounter difficulties in the correct determination of both morbid processes on account of the numerous and manifold relationship of the idiopathic and the cicatricial tumor. Virchow,[2] in view of the observation that some tumid formations termed keloid are of cancroid (cancerous), others again of fibromatous or sarcomatous and even syphilitic nature, has proposed to separate from keloid altogether all growths springing from cicatrices, and to apply this term only to the formations of spontaneous origin or arising from certain pathological processes. Microscopic examination, however, failed to bear out this view in the sense desired, inasmuch as the same structure was not always found in keloids of spontaneous origin, and according to the results obtained, keloid had sometimes to be included among the fibromatous, sometimes among the sarcomatous tumors. For in the one case the formation is mainly composed of connective tissue, in analogy with fibroma; in other cases again, the great tendency to relapses, the intractability of the affection, and the exceedingly profuse cell proliferation of the neoplasm are factors which pointed to a relationship with sarcoma.

Histological examination (Langham, Warren) taught that in the idiopathic or true keloid the papillary body and the cones of the rete appear intact, and on this fact is based the view that this new-formation is an interposed structure; while the cicatrix or the cicatricial tumor, in which these layers appertaining to the normal tissue are absent, permit the deduction that a normal portion of tissue, lost through ulceration or suppuration, is replaced by masses of connective tissue. Clinical is as appropriate as histological differentiation, and if in a special case we can show that the neoplasm has formed spontaneously, we are justified in concluding that it is a true keloid, as we are warranted, in the opposite case, where the tumor has been seen to develop from a cicatrix, in calling it a cicatricial keloid.

Warren states, in explanation of the peculiarity of keloid to re-form in its original extent after removal from its seat, that the disease of the vascular walls is present for a great distance and that the neoplasm is invariably reproduced from these structures.

According to these statements, the distinction between a true and a false keloid, where its development cannot be traced, would be purely histological. In this sense the statement of the above-named investigators goes perhaps too far, and it will not be so difficult to more closely define the clinical diagnosis of keloid for certain cases.

Kaposi[3] believes that in general we are able to form a probable diagnosis only, and herein the arrangement of the tumors and their seat, especially at the sternum, are said to furnish reliable auxiliaries in deciding in a concrete case on the presence of an idiopathic formation. I think, however, that these auxiliaries are not always sufficient for

[1] Deutsche Klinik, 1852, No. 33.

[2] "Die krankhaften Geschwülste," ii., p. 244.

[3] Hebra-Kaposi: "Lehrb. d. Hautkrankh.," 1876, ii., p. 204.

the diagnosis, and as we have no certain landmarks of the origin of keloid, but know of the cicatricial keloid that it always develops after external irritations and injuries of the cutis, we shall in all cases where the latter factor is absent and the well-known characteristic formations arise nevertheless, be able to declare positively for the presence of an idiopathic keloid.

In favor of the correct clinical diagnosis of true keloid it should be emphasized moreover that very often we must acknowledge a peculiar quality of the skin over certain regions of the body which predisposes to these affections. Under this head belong probably both those cases in which keloid develops in larger numbers spontaneously, and those in which certain manipulations affecting the deeper cutaneous tissues readily produce prominent, scar-like tumors which only temporarily yield to extirpation and always form anew. Without applying the word or the conception of a diathesis in this connection, I think that we cannot disclaim the idea that certain forms of tumors generalize on the common integument in this way, that they are of spontaneous origin, often multiply extraordinarily without cause, and according to the number of formations they produce, represent as it were certain gradations in the morbid disposition. I believe myself all the more justified in this assumption as I have several times observed forms of multiple keloid develop which could without difficulty be included in the series of generalizing cutaneous tumors, in which only the common integument and not the remaining constitution could be called pathological.

The tendency to appear generally is displayed sometimes also by different forms of tumors so that the idea of a diathesis seems to suggest itself likewise in the case of other tumors. As regards the multiplicity of keloids as well as of other tumors of the skin, we can indorse Virchow's view about the multiplicity of myomas : "It has nothing at all to do with malignancy and heteroplasia, nor is it to be conceived as the expression of a dyscrasic general affection, but as an essentially local phenomenon. Every single tumor is the product of a local irritation, the multiplicity means nothing but the extent of the irritation." [1]

Keloids occur usually as isolated structures, and their favored location is the trunk, especially the sternal portion. Even where they are multiple, the extremities are generally spared ; I have but very rarely observed their occurrence in other places than those named. Cazenave[2] reports the case of a young woman who had upwards of twenty keloids, partly on the chest, partly on the superficial lymph cords (!) of the upper and fore arm. Bazin[3] makes this general remark about it : "Its site of predilection is the sternal region. It is found also on the neck, face, and limbs, and it may be said that no part of the body is entirely exempt." He also mentions a case under his observation in which the abdomen, the region of the hip, and the surfaces of the thighs were covered with numerous keloid tumors. Of course, this applies only to cases of spontaneous and not the above-mentioned cicatricial keloids which may occur anywhere, especially after burns.

Cases are also on record where scar-like, tumid new-formations of tissue (true fibrous tumors) have developed on fingers and toes ; but these structures, though histologically related to keloid, represent clinically essentially different tumors.

There are rarely more than twenty to thirty distinct keloids. Wilson[4] observed a

[1] L. c., p. 118.

[2] "Abrégé pratique des Maladies de la peau." Paris, 1847, p. 603.

[3] "Leçons cliniques et théoriques sur les affect. cutan. artificielles." Paris, 1862, p. 265.

[4] "Diseases of the Skin." London, 1876, p. 381.

case in a lady who had thirty distinct tumors in front of the chest and nine on the back. Some years ago I published some observations among which was a case with one hundred and five separate keloid tumors.[1]

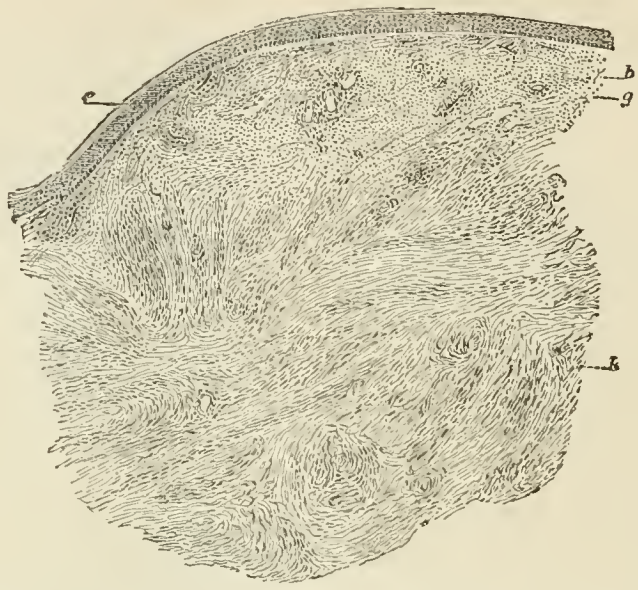


FIG. 58.—KELOID OF SYPHILITIC ORIGIN from the cheek of a girl aged fifteen years ; *e*, moderately atrophic epidermis; *g*, granulating superficial cutis tissue with patent or obliterating proliferating vessels (*b*); *k*, keloid tissue with numerous cells partly arranged in long spindles of stellate form.

The ANATOMICAL ALTERATIONS (Babes) have frequently been the subject of careful examination. While the cicatrix necessarily affects the entire parablast, keloid induces mainly new-formation of the dermatic frame-work. The fact that keloid frequently develops after injuries in place of cicatrices and arises just like the cutaneous cicatrix, renders it probable that the peculiarity of this formation is influenced by that of its points of origin. In recent cicatricial keloid we can observe how the firm cicatricial fibres swell and dissolve into dense bundles of spindle cells which are but a monstrous reproduction of the cicatricial network; at the same time the wall of the peripheral blood-vessels proliferates, while the central vessels appear relatively sparse and narrow. Keloids after syphilitic ulcers (Fig. 58) are distinguished by superabundance of cells and transition into granulations, while those of tubercular or scrofulous origin have few cells and resemble sclerotic connective tissue. In idiopathic keloid, the cicatricial groundwork is absent; it is marked by greater independence and deeper position of the tissue basis, whereby the papillæ are left intact; particularly noticeable is the almost tendinous, regular tumor tissue running parallel with the surface; here we find lymph vessels with endothelial proliferation which run parallel towards the surface, patent and vertical, but probably compressed by the longitudinal growth of the fibres. In some keloids the cellular network bordering the elements of the dermatic frame-work concurs with the latter; especially when the trabeculæ have become sclerotic or hyaline, there is often found between them a network of large stellate or fusiform elements. In multiple keloids the peculiar scar-like quality of the skin seems to furnish the disposition to the new-forma-

[1] Vierteljahresschr. f. Dermatol., l. c., 233.

tion. The following case, most interesting on account of its extent, came under my observation.

A girl aged seventeen, of vigorous build, had a keloid reaching from the sternal region almost to the right of the spinal column; it consisted of a large number of tubercles, partly isolated, partly confluent, in size from that of a bean to that of a hazel-nut; firmly seated in the subcutaneous tissue, little movable, moderately painful on pressure. The color was partly that of the normal skin, but here and there they had a reddish shining appearance, some of the formations seeming to be traversed by a larger number of fine vessels. The tubercles, though irregularly placed, are massed together in the space between the fourth to the seventh rib, and thus nearly corresponding to the course of the ribs, they extend across the well-developed mamma in considerable numbers as far as


FIG. 59.—KELOID-LIKE NEW-FORMATION from the cheek of an older patient.—Cylindromatous keloid (Hartnack, camera lucida 7): *h b*, connective tissue trabeculæ changed by hyaline swelling into cylindrical masses; *h b z*, swollen connective tissue cells between and on the trabeculæ; *l y*, lymph-vessels. (The tumor was the size of a hazel-nut and exhibited an evident growth. The latter represented a cylindromatous alteration of the dermatic frame-work and was surrounded by a swollen network of cells—one form of the cylindroma of writers.)

the axillary region. While maintaining the character of firm tubercles in the sternal region and the lower part of the mamma, they become much flatter and less prominent within the mammary gland, but they can be well circumscribed throughout, with few processes extending into the glands and the cutaneous tissue.

Still more interesting is the dorsal portion of the trunk, where the isolated tubercles, at the time of admission, were much more largely developed, making the region between the fifth and the ninth rib appear as one tumor sending processes laterally, upward and downward into the healthy skin. They thus formed isolated and confluent tumors which in their partial coalescence represented the shape of a semilunar and irregularly lobulated swelling. The skin over the dorsal tumor, including those at its borders, measured 10 cm. in length and 8 cm. in breadth. As in the preceding case, the epidermis at some points is closely adherent to the tumor, but at others it allows some wrinkling when the lateral edges are pushed together. The entire dorsal tumor is of a reddish color throughout, and there is an absence of the dull white appearance met with in some keloid affections of the isolated form. A delicate capillary network ran over the whole new-formation. The several nodes were neither specially sensitive nor painful; during the entire duration of the disease the patient never had cause to complain of any subjective accidents.

The condition of the skin in general in our patient was remarkable. While the skin of the face showed numerous comedones, there were on the skin of the nucha, the abdomen, the surfaces of the trunk not invaded by keloid, numerous isolated discrete glossy spots resembling a cicatricial formation, and the common integument altogether could be called abnormal.

In this as as well as in a second case of keloid which had appeared on both auricles and in discrete nodes and tumors reaching from the trunk to the region of the knee, microscopic examination showed the epidermis to be somewhat thickened in the form of papillary cones, here and there thinned; immediately underneath were several nests

of granulation tissue; then followed a dense layer of wavy elastic fibres and felted masses, as a rule lying parallel, which constituted the bulk of the tumor. Beneath, surrounded by a dense elastic tissue, ran connective tissue trabeculæ in a state of great hyaline swelling, then followed trabeculæ of healthy muscular fibres and slightly sclerotic vessels; a gradual transition into a reticular cartilage, above very rich in elastic fibres, concludes the picture.

The CAUSES of keloid are in general very obscure, and, as above stated, unless we presuppose a peculiar disposition in consequence of which the skin is readily involved in such diseases, and in which local irritations or slight lesions furnish the stimulus to the development of this neoplasm, we can find no other plausible landmark for its origin. I often observed keloids arise after incisions into the skin for the evacuation of abscesses; they are also met with after the use of vesicants, leeches, after piercing the ear lobes for the insertion of ear-rings, etc. In a young man who had on the fingers and the hands numerous warts, which I removed by cauterization with nitric acid, many keloids developed after the healing of the artificial dermatitis, that is, one neoplasm from each suppurating spot. Of morbid processes syphilis might be mentioned as liable to lead to the development of keloids after long-continued ulceration. The age has no bearing on the appearance of this formation; small children are more rarely affected with it than adults; in more advanced age or in old people it is exceedingly rare.

The TREATMENT is absolutely powerless in keloid; removal of the neoplasm by caustics is as fruitless as by surgical interference, the keloid always develops anew. Less energetic agents such as iodine, mercury, or absorbents of all kinds do not act any better. If pains occur in the cicatricial tumor, which is of frequent occurrence, narcotics should be given internally; or externally, chloroform, oleum hyoscyami, opium liniment, which always have their symptomatic value.

## FIBROMA, TUMOR FIBROSUS; FIBROID, DESMOID.

This tumor represents a new-formation in which the basis substance consists mainly of connective tissue, with a slight participation of cellular elements.

DEVELOPMENT OF FIBROMAS AND OF SOME RELATED FORMS.—Fibroma develops in the form of firm and dense connective-tissue trabeculæ which, according to their arrangement, represent harder or softer structures. Hence we can speak of hard and soft fibromas; but there are certain intermediate forms, such as the papillary and verrucose fibromas, in which increase of epithelium ensues, and the entire tumor shows a tendency to malignant epithelial formations. A frequent neoplasm of the skin, histologically related to fibroma, in which greater or less participation of the epithelium can be demonstrated, is formed by the papilloma. In the beginning the enlarged papillæ generally do not bulge out the covering layers of the skin, and the surface appears smooth; not until the thickened or œdematous epidermis degenerates close beneath the corneous layer and disintegrates with desquamation and rupture, do the papillomas appear separate and visible. At times the loosened interpapillary tumors—exhibiting colloid or œdematous strips and being even strangulated—are still encapsulated in the corneous layer; in other cases the papillomas remain connected by a cornified epithelial layer, as in hard warts, cutaneous horns, etc. As has been stated, these peculiar papillary proliferations are transitional forms between fibromas and other connective tissue new-formations, among which belong also, clinically, some cauliflower growths, such as the proliferations of the skin in elephantiasis which Virchow includes among the fibro-

mas, as well as the papillary new-formations in pachydermia, the neuromata developing from the nerve sheaths, etc. Some forms of papillary warts which must be termed fibromas sometimes show indubitable relations to the nervous system, such as the congenital nerve nævi, often corresponding unilaterally to the distribution of peripheral nerves.

The soft fibroma (Fibroma areolare; F. molluscum, Molluscum fibrosum) represents firm tumors consisting of connective tissue covered with normal skin. They appear as barely visible formations the size of a pin's head, but are usually as large as a bean, and may form large tumors, as in a case recently reported by Schultze, where the tumor covered the greater part of the head and face ;[1] they may also reach a colossal size, as in a case described some time ago by Marcacci,[2] where the molluscum, in the shape of a scar-like neoplasm, acquired such dimensions that thorax and back seemed completely enveloped by it. Generally, however, these fibromas occur as hemispherical isolated or multiple tumors, either imbedded in the cutis or provided with a usually short pedicle. Where large tumors are met with, we generally find smaller formations scattered over the body. The skin above the tumor, though generally unchanged, is frequently rugous and warty, and when the fibromas are seated close together, the entire surface of the skin acquires a grape-like appearance. At times we can also feel in the depth tubercles belonging to these formations which may be interpreted as fusiform thickenings of the nerves. Some fibromas appear as even, flat thickenings of smaller or larger portions of the skin; they then form pure hypertrophies of the skin—a sort of pachydermia and elephantiasis (fibroma molluscum planum).

Such a flat form we observed on the forehead of a boy aged fourteen, in the shape of a whitish tumor connected with the surroundings by lobular cords ; it was covered with tense immovable skin, and was about the size of a dollar. Microscopic examination showed under the epidermis, which had lost its papillæ, a dense undulating connective tissue with indistinct fibrillæ, here and there proliferating vessels (*b*) ; the bulk of the tumor extended from there into the depth in lobules between the columns of fat, in the shape of an ordinary periarterial (*a*) and perineural areolar new-formation.

The soft fibromas are usually congenital, spring generally from the portions of the parablast which form sheaths, *i. e.*, the adventitia of the vessels, the nerve sheaths, and the interfascicular connective tissue, from the tunica propria of the glands, at times also, according to Virchow,[3] from the framework of the subcutaneous fat-tissue. They are quite painless, becoming inflamed only through external irritations. The isolated tumors are easily enucleated, are often wide-meshed, loose, sometimes with nodular processes, the cut surface smooth and whitish; frequently they can be disentangled as tumid convolutions (Czerny, Recklinghausen). In the skin covering the molluscum we sometimes find sebaceous glands filled with sebum which can be expressed so that they lose a part of their contents, as the so-called molluscum sebaceum s. contagiosum. This should be borne in mind, because where tubercular formations are plentiful, we often find, besides fibroma molluscum, also those nodes filled with masses of sebum (M. contagiosum).

Within the framework of the fibroma isolated nerve fibres and vessels are occasionally found. Whether there are indeed intimate relations existing with the nerve substance and whether the tumors spring from it cannot be clearly proved.

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[1] Deutsche Zeitschr. für Chirurgie, 1880, 5 u. 6 Heft.

[2] Giornale italiano delle malat. della pelle, 1879, p. 131.

[3] " Die Lehre von den Geschwülsten," Bd. i., p. 221.

The firm or hard fibroma forms a new-formation of connective tissue fibres compacted into a dense structure; it occurs on the trunk or the extremities, usually isolated, and from the size of a pin's head, may develop into tumors nearly one-third metre in diameter. The several tumors are generally seated deep in the cutis, are sharply circumscribed, covered with a smooth epidermis, and only when several formations coalesce, the surface acquires a grape-like appearance. As they maintain the physiological type of the connective tissue, these fibromas develop most readily from the connective tissue portions of the skin, but also with equal facility from the connective tissue of the muscles and nerve sheaths, in which latter case they are called neuromas. The cut surface of


FIG. 60.—FIBROMA MOLLUSCUM PLANUM FROM THE FOREHEAD: *e*, atrophic epidermis; c, superficial layer of cutis with *b*, partly obliterated vessels; *s*, convoluted sweat gland; *f*, subcutaneous columns of fat; between the latter the tumor, consisting of succulent wavy connective tissue, extends downward; *a* and $a_1$, arteries; *n* and $n_1$, nerves; *m*, muscle-fibres.

the single tumor has a whitish, glossy aspect, is smooth, dry, bears some resemblance to tendons, and has homogeneous layers.

The hard fibroma develops very slowly, and as it forms, as it were, from out of the cutis, it causes atrophy of the normal surroundings by its firm consistence. In that case, the single tumor can not only be clearly circumscribed, but be completely enucleated; we may can find central vascular or nerve sheaths before the tumors have become too old. Recklinghausen[1] has called particular attention to the latter circumstance, and his investigations showed that the nerves play a prominent part in the development of fibromas; for the connective tissue tumors forming from their sheaths gradually displace the nervous elements, a true fibroma having arisen from the original neuro-fibroma. The grouped fibromas and the so-called true irritable tumors therefore bear an unmistakable relation to the nerves; they usually form subcutaneous nodules the

[1] "Die multiplen Fibrome der Haut," u. s. w. Berlin, 1882.

size of a lentil, often also larger tubercles having a marked sensibility. Such an irritable fibroma is depicted in Fig. 61. The centres of the deep-seated tumor, with concentric fibres, are formed by a thick-walled vessel. The tumor continues into the depth in the shape of a pedicle containing loose nerve bundles; at the periphery are found nerves imbedded in sclerotic tissue; the tumor consists of thin, long fibres, with here and there fusiform and club-shaped swellings, and provided with nuclei; it contains a moderate number of capillaries and comparatively numerous lymph-spaces. In the centre are scattered myelinic and amyelinic nerve fibres, here and there between them a cell resembling a ganglion. (Comp. Fig. 62.)

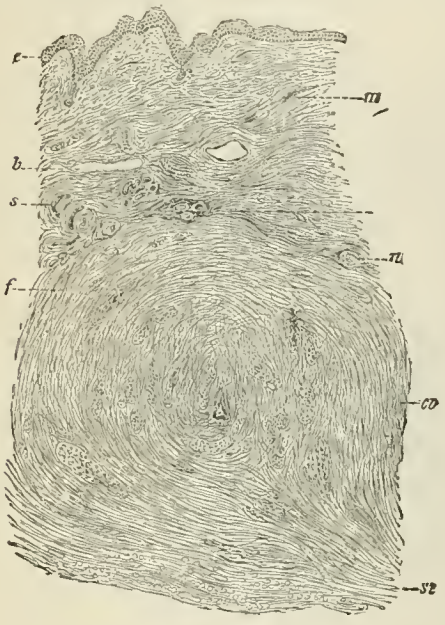


Fig. 61.

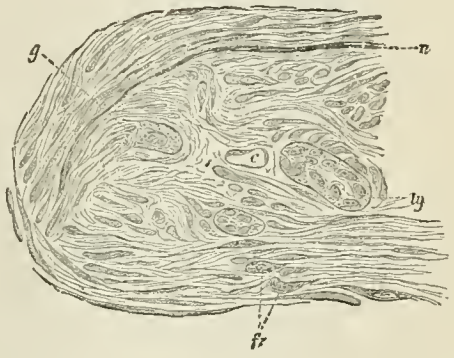


Fig. 62.

Fig. 61.—Neuro-Fibroma (Ganglion) dolorosum from the Back (Hartnack, Camera lucida 2) : *e*, thin, wrinkled epidermis; beneath it, a very loose succulent layer; this is followed by a wavy connective tissue, with thick fibres; *m*, smooth muscle fibres independent in the connective tissue; *b*, dilated lymph-spaces; *s*, convoluted sweat-gland; *g* and *n*, vessels and nerves in the sclerotic tissue having thickened sheaths; *c v*, vein in the centre of the tumor; *s t*, stem-like connective tissue bundles containing atrophic nerves.

Fig. 62.—A Part of the same Tumor (Hartnack, Camera lucida, Immersion No. 9) : *f z*, connective-tissue fibres, with cellular swellings; *n*, scattered nerve fibres; *g*, ganglion cell (?); *c*, blood capillaries; *l y*, lymph-vessels, with distended endothelia.

Attention should here be called to still another form of fibroma which occurs mainly with hypertrophy of the skin, and which we have found in a case of angioma racemosum of the skin of the finger; on the nerves with fibrous thickening were seen oval corpuscles the size of a lentil which might perhaps be designated as fibromatous Pacinian corpuscles.

The clinical importance of the fibroma depends not only on the density of the new-formation, but also on the disturbance it causes in the neighborhood of the tissue in which it is imbedded; probably it never gives rise to malignant accidents, except by the increase of its cellular and disappearance of its connective tissue elements; but then the fibroma changes into a sarcomatous form and loses its original clinical and histological character.

The termination of the hard fibroma is manifold; sometimes it undergoes fatty degeneration, sometimes ossification or calcification; there may also occur a sort of softening through increased abundance of blood within the tumor; at times, too, a telangiectatic form, with transition into true blood cysts, caused by vascular dilatation. Such a hemorrhagic fibroma cyst is represented in Fig. 63.

Diagnosis.—The above-described qualities of fibroma, it seems to us, leave no difficulty in deciding whether we have to deal with a soft or hard connective tissue tumor. It could be most readily confounded with molluscum sebaceum or contagiosum. Attention should therefore be given to the peculiarities enumerated in the symptomatology of fibroma, especially to the smooth, even surface of the skin, while in the formations due

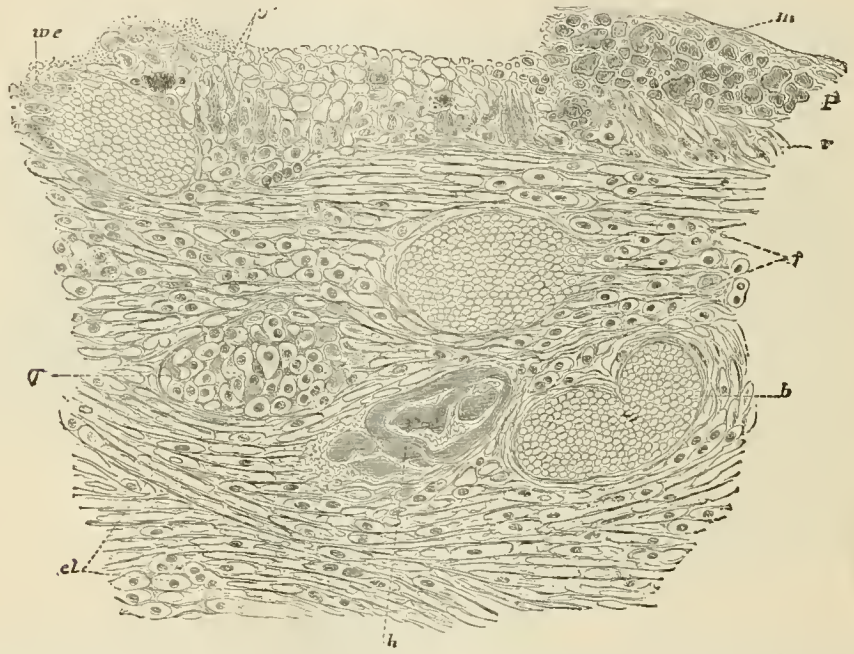


Fig. 63.—Fibromatous blood cyst from the subcutaneous tissue of the hand; *m*, neomembrane of the blood cyst; *P*, a layer of pigment flakes beneath the neomembrane; *r*, a second layer consisting of hyaline reticular unyielding tissue, with swollen connective tissue cells (*g'*); *w e*, proliferated endothelia of a superficial blood-vessel; *f*, fibres of the fibroma tissue with elongated plasmatic channels containing cells; *b*, ectatic blood-vessels; *q*, transverse section of a fasciculus with ectatic plasmatic channels; *g b*, swollen connective tissue cells; *e l*, ectatic lymph channels; *h*, hyaline flakes in a transversely cut vessel.

to disease of the sebaceous glands the efferent duct of the latter will always be found, and pressure on the tumor will expel the contents in the shape of a sebum-like, pasty mass, and at the same time cause a relaxation of the skin. We have stated above that such formations may also be associated with fibroma, in which case the molluscum sebaceum can be more easily distinguished from the fibroma after its contents have been expressed; should, however, a small amount of sebum be expelled from a fibroma (through accidental transformation of a sebaceous gland into a fibroma tubercle), the connective-tissue frame-work of the latter will still be preserved, and although the formation will be somewhat relaxed, it will not be diminished in size.

Fibromas, when they occur as multiple neoplasms on the integument, strike the eye by the number and consistence of the several tumors, and the histological examination will easily elucidate their nature. Even the rare forms of general disease of the

lymph glands, in which all the lymph glands represent lobulated, grape-like, painless tumors,[1] will permit a correct diagnosis from the seat of these tumors and the evident enlargement here and there of the lymph vessels. Behrend[2] also points out the possible confounding with Cysticercus cellulosæ: the latter affection is exceedingly rare, the several tumors are of equal size and not different as in fibroma; they always show, moreover, a firm, uniform consistence.

The CAUSES of fibroma are quite obscure, often a hereditary tendency was assumed, but frequently cannot be demonstrated; in the majority of the cases the fibromas appear in earliest youth. In some cases local irritations were cited as causes, but fibromas are seen to occur where such irritations cannot be demonstrated.

The TREATMENT of fibromas can only be surgical, and in cases where they call for interference owing to disfigurement, or of spreading of the tumors, ablation of the neoplasm is indicated, whether by simple ligature, the knife, scissors, or the galvanocautery. As these tumors are provided with numerous blood-vessels, hemorrhage should be guarded against during operative removal. Should the fibromas reach such an extent that surgical interference is out of the question, or if they could not be readily removed on account of their multiplicity, these dermatological curiosities may be left alone, as they do not at any rate endanger life.

## 4. XANTHOMA (XANTHELASMA VITILIGOIDEA).

SYMPTOMS.—The term xanthoma is applied to a form of macular or nodular formations which occur on the common integument in the shape of light or dark yellow (the shades range from straw to sulphur yellow) stripes, plates, or protuberances, partly discrete, partly confluent, which present no subjective symptoms, and are incapable of spontaneous involution. The persistence of the affection, and the fact that in some cases it has a strong tendency to spread to different parts of the body, justify us in regarding this disease clinically as a neoplastic formation, and this view is fully borne out by histological examination.

Rayer[3] was the first to describe this affection; he speaks of it as a special disease in which we sometimes observe on and around the eyelids yellowish plaques which, "slightly salient, soft, without causing heat or redness, are symmetrically placed on the skin." Subsequently Addison and Gull described this affection independently, and applied to it the name vitiligoidea. These authors, too, were the first to distinguish two varieties, namely, a flat and a nodular form (vitiligoidea plana et tuberculosa). The title xanthoma was given to this disease by Smith,[4] and xanthelasma by Erasmus Wilson; the number of observations has been considerably enlarged within the last few years, so that this affection can no longer be called rare, though it is not one of the most frequent diseases.

We retain the clinical division of Addison and Gull as the most appropriate, and describe xanthoma in its two forms as follows:

1. *Xanthoma planum* forms yellowish white or citron yellow spots the size of a thumb nail or larger, usually occurring at the canthi of the eyes or the eyelids of both sides, and generally symmetrically; they are met with also on other portions of the face, the

[1] Amicis, Annales de Dermatologie et Syphiligrafie, 1882, p. 452.
[2] "Lehrbuch der Hautkrankheiten," Berlin, 1882, p. 399.
[3] "Traité des malad. de la peau." Paris, 1835, avec Atlas.
[4] Journal of Cut. Medic., 1869, iii., p. 241.

skin of the cheek, nose, the nucha, and in isolated cases even on the mucous membrane of the mouth. Pye Smith[1] found similar spots on the palate, and at the autopsy in the œsophagus; Legg,[2] at the bifurcation of the trachea and in the capsule of the spleen; Virchow reports a case from Graefe's clinic, in which a xanthoma had developed on the cornea,[3] etc. The several spots are flat, have generally a smooth, velvety feel, and in side light they appear as alterations projecting above the level of the skin, chiefly conspicuous by their color. The isolated spots can sometimes be recognized as composed of several apposed or coalescing small structures, especially in those forms in which the skin within the spots projects here and there in small nodules. The skin thus altered can be easily lifted in folds, has a slightly doughy feel, but does not materially differ to the touch from a normal fold of skin. The several spots are always sharply demarcated from the surroundings, never exhibit any desquamation, and are not painful to the touch.

2. *Xanthoma tuberosum et tuberculosum* differs from the preceding form by the presence of nodules and tubercles appearing in varying shape and size, the several formations representing isolated or confluent tubercles the size of a hemp-seed, lentil or beans and the massing of the formations makes the impression of a conglomeration of grape-like, lobulated tumors. Xanthomas thus closely arranged are a rare form of the diseases The several nodules are covered with a smooth, soft skin, disclose a firm texture on pressure, are imbedded in the corium, and often extend down to the deeper connective-tissue layers. These forms occur only exceptionally on the eyelids, but more frequently in the face, and in larger numbers on the most various parts of the trunk, on the extremities, usually round about the joints, especially the elbow and knee joint, and as flattened nodules even on the palms and soles. In some cases the hairy scalp is not exempt, and even the genitals (Kaposi, Chambard) may be the seat of this new formation. In cases of general xanthomatosis, besides the nodular, the macular form is likewise present, the latter generally on the points of predilection above enumerated. The nodular form differs from the other also by the concomitant subjective accidents in that the several formations often pain spontaneously, and by their presence on the flexor surfaces of the joints not only somewhat restrict the mobility of the extremity, but also provoke the most disagreeable nervous sensations during the unavoidable muscular movements. Closely related to the nodular and tubercular form is the xanthomatous tumor described by some French physicians which forms isolated and confluent tumors ranging from the size of a nut to that of a hen's egg, and which, in the few cases thus far observed, was mainly located around the joints.

Both the nodular and the tubercular xanthoma represent diseases of one and the same nature, and usually the tubercular form is developed from the former. Where both forms co-exist, the several types are generally sharply demarcated from the start; some macular xanthomas at times exhibit on the eyelids the above-mentioned, small, grape-like elevations; but the forms of xanthoma which have a tendency to spread largely over the body develop rather the nodular and tubercular type.

Etiology.—The accidental coincidence of the cutaneous affection with disease of the liver led some physicians to seek a connection between the two disorders. This etiological factor deserves special consideration, as it is more frequently referred to than others, such as sex, age, or heredity. Chambard found among 58 cases collected from the liter-

[1] Pathological Society of London, 1879.
[2] Ibidem.
[3] Virchow's Archiv, Bd. 52.

ature, 30 females—a number which does not appear decisive as compared with the smaller number of male patients. Hereditary relations are perhaps more important. Hutchinson found xanthoma several times in a family in which the grandmother was first attacked by the disease. Church[1] observed the affection in two families among a numerous progeny; otherwise there are no examples on record which would give special etiological importance to heredity.

The question whether xanthoma depends upon different affections has likewise been the subject of repeated discussion; the attempt has been made to bring arthritise diabetes, extensive diseases of the sebaceous glands into connection with xanthoma; but these suppositions stand far behind the relationship of xanthoma formation with diseases of the liver, which has been several times referred to. But we must here make a distinction between liver affections as parenchymatous diseases and icterus which is especially charged with producing xanthoma. Among 27 reported cases, Kaposi found icterus 15 times; Hutchinson, among 36 observations, 6 times; and Chambard, among 58 observations, 22 times. I myself, among ten cases coming under my observation within the last three years, only 2 of which were extensive nodular xanthoma, have not found icterus present even once.

However, some observers who bring jaundice into connection with xanthoma, admit, that the icterus often preceded the cutaneous disease by many months, even years, and, in other cases, the icterus did not appear until long after the existence of the xanthoma. The number of cases which could be brought into connection with icterus is decidedly smaller than that in which xanthoma was observed without preceding or accompanying jaundice; hence if we are unwilling to look upon icterus as an accidental complication of xanthoma, we can find no plausible basis from which to deduce any relationship, all the more if we remember that icterus is an almost daily and xanthoma a much rarer disease.

As regards the causal connection between xanthoma and the parenchymatous affections of the liver, the relationship seems to be more favorable, inasmuch as some observations in this direction are said to amount to a proof. But the number of post-mortem examinations made on cases in which xanthoma during life could be brought into connection with disease of the liver is not large; some directly contradict the presence of affections of the liver during life, as a case of Maxon's,[2] who found a cicatricial constriction of the bile-ducts, and Legg's[3] who found a cyst obstructing the bile-ducts; in these cases the liver parenchyma was healthy. Murchison[4] found cirrhosis of the liver at the autopsy of a case in which there was a slight macular xanthoma on the eyelids; while according to Chambard,[5] in a person affected with multiple xanthoma, in whom during life hypertrophy of the liver was diagnosticated, this organ was found healthy, but numerous cysts were found imbedded in the right lung and in the liver. Extensive xanthomas without liver disease have recently been published by Carry, Brachet, and Monnard; these might serve as counter proofs of many other cases. I myself, among ten cases under my observation, have not once found disease of the liver. We may say, therefore, that the connection between affections of the liver and xanthoma cannot be employed in determining the etiological relations. It is better to confess our ignorance

[1] Bartholomew's Hospital Reports, x., 1878.
[2] "Pathologic. Transactions," 1873, vol. 24.
[3] Vide Chambard, Annal. de Dermatol.
[4] Journ. of Cut. Medic. London, 1869.
[5] L. c.

regarding the etiology of this disease than to drag in uncertain pathological factors for it at any price.

ANATOMY.—Anatomical examinations show that the spots and nodules have the same structure. The minute alterations exhibit an irritative process in the subcutaneous tissue with new formation of cells which affects all the elements equally. The first investigations were made by Pavy,[1] who had found, besides the connective tissue new-formation, deposition of fat granules and globules in its fibrous trabeculæ. Geber and Simon,[2] on the other hand, have defined the disease erroneously as a hyperplastic development of sebaceous gland cells. The investigations made by us were based on Hertzka's case, some excised tubercles of which we examined. The yellow color of this new-formation might be due to the fat which is deposited in it as a granular yellow mass; but whether this color is also derived from bile pigment, as was believed by older observers, is by no means proven.


FIG. 64.—XANTHOMA TUBEROSUM MULTIPLEX. A tubercle from the skin of the elbow: *s c*, stratum cornum; *r m*, rete Malpighii; *x*, cells in process of division; *v a*, vacuolæ, containing migratory cells and endothelia swollen into semilunar form; *l r*, lymph reticulum containing hypertrophic endothelium; *e r*, rigid reticulum; *n*, nerve; *c*, capillaries; *e l*, dilated lymph vessels; *V*, vein surrounded by concentric plasmatic channels.

The superficial, somewhat grape-like, yellow flat nodules, ranging in size from a lentil to a bean, are lax and fibrous; on section the cut surface appears whitish yellow, juicy, finely reticulated, collapsing, gradually blending with the surrounding tissue. The epidermis is thinned, and usually devoid of papillæ, showing here and there proliferating, at times crushed or distorted sebaceous and sudoriparous glands. The rete Malpighii (*r m*) contains atrophic cells, remarkably numerous young elements, here and there direct cell divisions. The deepest cell layer is strikingly darkly pigmented. Close beneath the epidermis follow dilated lymph vessels (*e l*) with swollen endothelia. Besides there are small, almost or entirely obliterated blood-vessels with similar endothelia having here and there hyaline contents. The wall is very much thickened, and forms a generally concentric sinuous network, whose deep communicating spaces are lined or filled with a layer of

[1] Guy's Hospital Reports, 1866.
[2] Vierteljahresschr. für Dermatol., 1872.

swollen cells containing small yellowish fat droplets. In the intervening trabeculæ we find roundish, yellowish red flakes of pigment, hyaline fibres, and smooth muscle elements. The lacunar system appertaining to a vessel is separated from the surroundings by larger lymph spaces. By the excessive development of a lacunar plasmatic channel system (*l r*), the vessels (*V*) with proliferated endothelia are crushed, and this process extends to all the normal constituents of the skin with the exception of the lymph vessels, so that the tunica propria of the glands and the sheaths of the nerves are equally alienated. The connective tissue trabeculæ are separated from each other by the development of similar formations, they swell up, and gradually also become hyaline.

The histological examination is likewise unable to answer the question as to the pathogenetic relations of xanthoma. The fact that the affection is sometimes observed to be general has suggested the idea that the origin of xanthoma may be traceable to a diathesis or cachexia; for general disturbances, especially digestive troubles, which occasionally lead to consecutive alterations in the liver, may be associated with its occurrence. Quinquaud,[1] starting from the idea that fatty degeneration of some glandular elements has been found histologically, holds a peculiar accumulation of fat in the blood to be the predisposing factor which leads to various deposits in the organism and the common integument—a view which still lacks confirmation.

Treatment.—The new-formed elements in xanthoma which are followed in part by the destruction of the normal tissue and superficial extension, or a neoplastic proliferation with tubercles and formation of tumors, cannot yield to any absorbent or alterative treatment, and where cosmetic improvement is aimed at, we can only resort to surgical manipulation. It is true, a few cases of spontaneous involution have been reported; but we might express some doubts as to the total retrogression of these neoplastic forms of tissue. Both the macular and the tubercular xanthomas should be removed with the knife, and thus disfigurement can be permanently overcome.

### 5. RHINOSCLEROMA.

The symptoms of this affection manifest themselves by a profuse formation of tubercles or wheals which, either isolated or confluent, form a large lobulated or grape-like tumor around the nostril, covering both the skin of the alæ nasi and spreading thence inward over the mucous membrane, forming hard structures. The several tubercles are either covered with normally colored skin or traversed by isolated fine vessels; thereby the epidermis often appears smooth and glossy, and, the hair-follicles and sebaceous glands having perished, dry and furrowed. The most striking peculiarity of this tumor is its uncommon hardness—Hebra compared it to ivory—it causes moreover a rather severe pain which is felt only on pressure on the tubercle, but not spontaneously. The occurrence of this new-formation in the above-mentioned locality gives to it such a character that it cannot be identified with any kind of similar structure on other parts of the body. Rhinoscleroma is a pronouncedly chronic disease of slow growth and tedious course which requires a number of years for its full development.

The disease usually begins as a swelling and infiltration of the skin either at the edge of the ala nasi or on the mucous membrane of the nasal septum; the several lobes enlarge, and finally gradually fill the cavity of the nose or cover the parts around the edge of the nose; subsequently the ala is distended by the tumor and broadened. In many cases where the growth of the masses toward the interior is somewhat hindered by

[1] Bulletin de la Société clinique, 1878.

greater resistance of the tissue and the septum, the neoplasm spreads also to the upper lip and enlarges downward in continuity with the point of origin of the tumor. The proliferation rarely goes much beyond the median line of the upper lip, but rather has a tendency to extend into the depth. The disease progresses in the free space until the lumen of the nose is nearly filled, then it extends to the choana, and when it has infiltrated the gums from the upper lip, the new-formed masses unite in the depth through the alveolar process of the hard palate and displace all the normal tissue of the skin and mucous membrane, of the muscles, and bones. At times the alveolar process of the upper maxilla is eroded under the cheeks, and then we find thick, hard wheals under the latter and bulging them out (Kaposi).[1] Sometimes the new-formation extends over the angles of the mouth from the upper to the lower lip and gradually narrows the opening (Mikulicz),[2] and in particularly severe cases proliferating into the pharynx, the isthmus of the fauces may be constricted to a very narrow fissure (Billroth). The disease usually develops only on one side, but a few cases have been observed where both nostrils were affected, the new-formations joining at the palate and extending laterally and downward. It is self-evident that under such circumstances not only the visible parts of the face appear altered, but also the mucous membrane of the nasal and oral cavities are pathologically changed in the same way, that they perish completely in the morbid process, and when the tumid masses pierce the covering integument, they present either with or without a thin cicatricial mucous layer.

It is a special peculiarity of this process that despite the extending alteration brought about by the ascendancy of the morbid tissue, neither inflammatory symptoms nor destruction of the tissue or ulceration occur in the surroundings and at the borders of the focus of the disease. Zeissl,[3] however, reports a single case where a rhinoscleroma was for some time treated as a syphilitic neoplasm; one of the tubercles suppurated and later ulcerated, which led to the destruction of the whole of the ala nasi down to the bone and finally the death of the patient. To the best of my knowledge there are no other similar cases on record. The rhinoscleroma itself not only progresses painlessly, but during its entire course is injurious to the local anatomical structures merely by obstructing the openings to the respiratory organs, and thus not only giving rise to important disturbances of function, but to dyspnœa, which can often be removed by artificial means alone. Rhinoscleroma belongs to the rarer forms of disease.

The DIAGNOSIS offers some difficulties in so far as, in its first stages of development, it shows great resemblance to syphilitic new-formations. Weinlechner had observed this disease before Hebra's time, in the year 1860, at Professor Schuh's clinic, without being able to ascertain its nature correctly, and had interpreted these cases (seven) partly as syphilitic, partly as carcinomatous. This was the case with most observers, until Hebra's publication called attention to the peculiarities of this affection. The utter failure of antisyphilitic treatment, the hardness of the tumor, the seat of the affection without any analogous forms on the rest of the body, serve to diagnose the disease and to exclude a specific affection. It could not be long mistaken for carcinoma, as the latter is never so extremely hard, leads to ulceration when it extends to the mucous membranes, and differs altogether from rhinoscleroma in the local and general incidents.

*Rhinophyma*—that neoplasm on the nose which leads to its enlargement and thick-

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[1] "Pathologie und Therapie der Hautkrankheiten," 2. Aufl., p. 633.

[2] Archiv für klin. Chirurgie, 1876, iii. Heft.

[3] Wiener med. Wochenschr., 1880, No. 22.

ening—is a doughy, soft tumor inclosing numerous dilated sebaceous glands, has a reddish lustre, is composed of several lobes, spreads only on and in the skin of the nose without disfiguring or destroying the mucous membrane of the mouth or nares, at most occluding the nostril by increase of the several tumors. It is a tumor developing to an enormous extent from an acne tubercle and, as far as can be learned from the meagre reports, has quite a different character from rhinoscleroma.

Anatomy.—Kaposi found in rhinoscleroma a small-celled dense infiltration of the corium and the papillæ, and placed this formation by the side of the small-celled sarcoma. Substantially the same view was expressed by Weinlechner and Mikuliez.[1]

According to our investigations, the bulk of the tumor consists of a round cell tissue which contains a number of connective tissue trabeculæ and partly destroys the original tissue; it seems that the blood and lymph vessels form the starting-point of the infiltration, for the cells of the adventitia and its surroundings proliferate largely.


Fig. 65.—Part of a rhinoscleroma of the introitus of the nose, the size of a hen's egg; *e*, epidermis with vacuoles (*va*); *ly*, lymph spaces; *g*, arborescent tissue resembling granulations; *s*, uncoiled convoluted sweat gland; $n_1$, nerve with intrafascicular connective tissue exhibiting hyaline swelling; *a*, arteries in the meshes of the cellular network; *m*, hypertrophic or disintegrating muscle fibre; *v*, vein imbedded in the cellular network; *kp*, cartilage; *ef*, elastic fibrous network plentifully imbedded in the tumor; *t*, sebaceous glands.

The epidermis appears moderately atrophic, here and there devoid of papillæ, contains vacuoles, and is provided at intervals with sparse hairs. The sebaceous glands proliferate in places (*t*); in the depth are some sweat glands whose convolutions have

[1] Archiv für klin. Chirurgie, Bd. xx., 1876.

perished. Wide lymph and blood-vessels extend immediately under the epidermis; between them is an almost embryonal loose tissue; then follows, especially around the sweat glands, whose veins, capillaries and walls it implicates, a network of dense, small-round-celled and short-spindle-celled proliferation, the wide interspaces of which are filled either with arteries (*a*), having a much thickened and sclerotic adventitia with a very profuse network of elastic fibres (*e f*), or a connective tissue abounding with a similar elastic tissue. The density of the cellular proliferation increases in the depth, where it represents a tissue with alveolar grouping, the cells of which are rather broad, often exhibiting hyaline or mucous swelling; within them are occasionally nuclei in indirect division. The part of the nasal cartilage (*k p*) imbedded in the tumor has become fibrous in its peripheral portions, here and there calcified, even ossified, proliferating; in the depth almost cystic in places by proliferation and degeneration of the elements. The muscle fibres, sebaceous and sweat glands in the tumor are here and there hypertrophic, proliferating, and imbedded in tumor tissue. The nerves partly show all the stages of neuritic degeneration (*n*), in part their interfascicular connective tissue is enormously swollen and structureless ($n_1$). In and around the tumor are many mast cells, the granules of which might be mistaken for bacteria.

Therefore the histological results furnish some information regarding the nature of rhinoscleroma, inasmuch as we can consider it a small-celled new-formation related to the sarcomatous process, while other authors included it among the chronic inflammatory processes. The cause of the affection is not yet quite clear. Frisch,[1] basing his view on a series (twelve) of observations, stated that within the cellular formation bacteria occur which can be made visible as small short bacilli by staining them with aniline colors; these bacilli are very numerous in distended cells three or four times the diameter of embryonal cells, and Frisch holds this enlargement of the cells to be the consequence of the bacterial irritation: even in the spindle-shaped cellular elements such bacteria could be demonstrated. As the result of his observation, Frisch thinks himself justified in assuming the existence of a special form of bacteria peculiar to rhinoscleroma—a theory which still lacks confirmation, as in the present era of bacteria every new form which appears must undergo the process of purification and experimentation.

Treatment.—The treatment of rhinoscleroma is purely surgical, and operation will be called for when the growth of the tumor either produces disfigurement or is followed by grave disturbances of respiration and deglutition.[2]

If it be possible, by ablation with the knife or galvano-cautery, not only to remove the morbid tissue, but also so much of the healthy tissue that the entire surroundings of the diseased patch are extirpated, thus preventing a re-formation of the original affection, it could be called a complete cure; but the nature of the disease and its course along the tissues rarely permit this operation on account of the disfigurement and the sequels which would prevent a favorable cicatrization; we must restrict ourselves, therefore, to keeping the nasal passages open as long as possible by the insertion of tubes of rubber, caoutchouc, and lead, and to extirpating particularly troublesome proliferations from time to time.

[1] Wiener med. Wochenschr. 1882, No. 32.

[2] While this work was passing through the press, I received an article by J. Lang (Wien. med. Woch., 1883, Nos. 24 and 25) who instituted strict antiseptic treatment with favorable result.

# PARABLASTIC TUMORS WHICH PRESENT IN THEMSELVES THE CONDITIONS NECESSARY TO STASIS.

BY

VICTOR BABES, M.D.

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## 1. LIPOMA.

THE term lipoma of the subcutaneous adipose tissue is applied to new formations of true fat tissue; probably in the main new-formation of the fat-depositing vascular apparatus with insufficiency of the arrangements for carrying off the fat. Obesity becomes a diffuse tumor, hereditary lipomatosis (polysarcia), when these conditions are diffusely present. The cause is frequently to be found in hereditary tendency. Circumscribed hypertrophy of the adipose tissue of the face, neck, toes (often with atrophy or hypertrophy of the bones) is also sometimes congenital.

Similar conditions may also be of neurotic nature; *e. g.*, many cases of circumscribed lipomatosis, pseudo-hypertrophy of the extremities.

When the body emaciates, there often remain circumscribed deposits of fat—lipomata—probably as the expression of abnormal vascular arrangement. But similar tumors arise independently in the subcutaneous cellular tissue, often in locations which are he seat of fatty excrescences in certain human races and species of animals; they are very frequent on the nates, the back, the axillæ, the abdominal wall, the thighs, the head. Finally lipomata may occur in consequence of traumatic irritations. Forms springing from cicatrices are not rare.

Circumscribed lipomata usually form movable tumors, ranging in size from quite small to very large; in the latter case they are prominent, often pendulous; the skin covering them is rarely thickened, brownish, generally thinned; the structure is coarsely lobulated which becomes evident when the investing skin is made tense. They are sometimes found subdivided into smaller lobules; more rarely they are smooth, roundish, often so soft as to be almost fluctuating, sometimes crepitating under pressure; in other cases the tumor is firmer to coarsely fibrous (lipoma fibrosum). The development of lipoma becomes particularly distinct in nævus lipomatodes.

Lipoma is as a rule sharply circumscribed, encapsulated, bulging out in sections, often of a darker yellow than the normal adipose tissue, and frequently traversed by a broad white or grayish translucent mesh-work. Histologically we recognize in lipoma the structure of normal adipose tissue; but the mesh-work of the tumor is coarser and generally contains fewer vessels, and the single fat-cells are larger than those in normal adipose tissue.

Lipomata often soften into oleaginous cysts, sometimes covered with a calcifi capsule. Pendulous lipomata at times change their seat in obedience to the law of gravity.

The DIAGNOSIS of lipoma usually presents no difficulties.

Lipomata are absolutely benign tumors. Very large forms are often obnoxious by their seat, their weight, and the disfigurement; they may also ulcerate or become gangrenous superficially. Healing of the wound generally occurs only after the discharge of necrotic shreds of tissue; not rarely erysipelas sets in there. For this reason, especial care in the treatment of the wound is indicated.

When mixed with other tumors, especially myxoma and angioma, lipoma may become grave; very extensive metastases of myxomatous lipomas have been reported.

## 2. MYXOMA OF THE SKIN.

The new-formation of mucous tissue forms a natural sequence to lipoma. The former likewise is most frequently caused by new formation of embryonal tissue with defective efferent vascular apparatus. But adipose tissue as such does not participate in the process. Accordingly we shall here remark in regard to the definition of Köster—who looks upon Virchow's mucous tissue as nothing but œdematous connective or adipose tissue, and myxoma simply as an œdema, a congestive alteration of a fibroma or lipoma—that though œdema plays herein an essential part, the greatest stress must be laid on the development of a new tissue which carries in it the condition for this œdema and an independent growth.

Hence congenital œdema of the skin affecting a tissue capable of proliferation will lead to a condition which might be called a diffuse myxoma, myxomatous pachydermia; this includes perhaps diffuse myxomas of the mammary gland. A similar tumid pachydermia formed, in a case observed by me, from hypertrophy of the cutaneous muscular tissue whereby the outflow of the tissue juices was interfered with. Such conditions produce myxomatoid formations in an umbilical cicatrix (fungus umbilici). Myxœdema seems to be a diffuse myxomatous condition causing congestion through nervous influences. In polypi, the simple abnormality of the vascular apparatus, of mechanical origin, forms the predisposing factor for the development of the myxoma.

The true myxoma is rarely solitary. In some cases it forms quite superficial, often large, pedunculated, grape-like gelatinous tumors of the mamma, the labia, or the scrotum; that is, of those parts where the skin is loose and contains many smooth muscle fibres whose hypertrophy might furnish the causative factor. On the thigh, the surface of the abdomen, the back, the hand, the cheek, etc., there may develop intermuscular myxomas which subsequently project into the skin. Furthermore, myxomas have been observed at the angle of the jaw, on the neck, perhaps in connection with embryonal fissures, also on the forearm, the buttocks, the forehead, and the lips. They formed lobulated or smooth, usually sharply circumscribed, gelatinous, tremulous, translucent tumors of the pure mucous tissue of Virchow, traversed by networks and islets of vessels. The

above-mentioned characters will in most cases elucidate the diagnosis. There is frequently an admixture of much elastic tissue. The cells of the tumor are round, stellate, or spindle-shaped, with mucous interstitial substance. In one and the same tumor, a part of the vascular network is often obliterated, while another seems to be excessively dilated.

Mixed formes are much more frequent. Thus lipomas and chondromas, the adipose or intercartilaginous substance of which is replaced by albumin and mucus, become myxomatous. More frequently, however, lipmatous myxomas possess this structure from the start. In the skin, papillomas and soft warts are sometimes myxomatous ; they usually contain also trabeculæ of fibrous tissue (fibrous myxomas). Vascular nævi not rarely become myxomatous. The above-mentioned fungus umbilici forms a fungoid tumor, sometimes ulcerating superficially, and consists of a plexus of vessels with hyaline walls and myxomatous or sarcomatous (sarcomphalos) interstitial substance. This tumor generally undergoes spontaneous involution. A persistent flat fungus with thin pedicle, the size of a dollar, which was extirpated from a young girl and examined by us, was of the above-mentioned myxomato-telangiectatic nature, with predominant participation of embryonal vessels and their processes. Not rarely sarcomas of the skin are at first myxomatous; they can be distinguished from the pure forms by their abundance of cells, and the admixture of fibro-sarcomatous or medullary portions. Colloid carcinomas can be differentiated by demonstrating degeneration of the cellular or interstitial portions, and by their grouping.

Myxomas are mainly benign and, if thoroughly extirpated, relapse very rarely ; but they may be multiple and injure the organism by their size. They form the subject of surgical treatment.

# TUMORS WITH PREDOMINANT PARTICIPATION OF VASCULAR RUDIMENTS.

BY

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UNDER this head belong the most frequent tumors of the skin—the soft warts, the sarcomata, most of the pigment tumors and angiomas. I shall restrict myself to a brief discussion of the etiology, anatomy, and diagnosis of these tumors.

## 1. THE ENDOTHELIAL NEOPLASMS OF THE SKIN.

Tumors formed of embryonal rudiments, in which the endothelia of old and new vessels play the main part, are more frequent than is generally assumed.

Among them belong, as endotheliomata of the lymph-vessels, most of the soft unpigmented and pigmented warts and sarcomas which have sprung from them, finally cancroid formations and, as such, many warts and sarcomatous structures of the blood-vessels.

*a. Endothelial warts* (*lymphangio-fibroma* of Recklinghausen, *verrucæ molles, carneæ*) is the name given to the ordinary warts which occur on the face, the genitals, the nucha, back, etc.; they may be smooth or grape-like, flat, hemispherical, at times have a broad pedicle, loose structure, brownish color, often are hirsute, whitish on section, translucent, sometimes pigmented, often almost gelatinous. The covering skin is generally somewhat thinned, more highly pigmented than normally; the papillæ are usually broadened by lateral growth, the papillary processes often extending into the depth and perhaps exhibiting isolated epithelial pearls. The most superficial cutis layer represents embryonal tissue with dilated lymph spaces. Then follows a network of crowded roundish endothelial cells which barely exceed leucocytes in size; between the meshes is connective tissue containing few vessels and nerves. The network was recognized by Recklinghausen as composed of lymph-vessels, the interspaces of which were filled with cells. The cells are most closely packed in the centre of the tumor, where the impression conveyed is often that of endenoid tissue abounding in cells. Laterally they are arranged in columns from the stretching which the connective tissue frame-work has undergone. Toward the upper and lower limits, the cells differentiate into cones and courses in which we recognize the lymph channels of the skin, filled with embryonal proliferated endothelial elements. The tumors start from the depth of the cutis. In most

cases they remain stable; often we observe a metamorphosis of the cellular cords into connective tissue which may entirely replace them in the shape of homogeneous fibres. The development from lymph spaces is best recognized in the pigmented forms, where the endothelia often swell considerably while the pigment is forming. The endothelial warts, therefore, are in the main neoplasms with an abundance of cells; for this reason we shall not, with Recklinghausen, call them fibromas.

As long as a carneous mole does not exceed the above-mentioned limits, as long as the neighboring tissue is free from any new-formation, and the neoplasm itself shows no sign of degeneration, we may consider it a benign structure which will forever remain so; but in its histological structure alone there is no point which would serve to differentiate it from an alveolar sarcoma. From a true adenoma, however, we shall readily be able to distinguish it by the absence of an epithelial arrangement, by the character and perishableness of the cells, by an accidental arrangement of the alveolar boundary, and in the central parts by the change of the cell-groups into a mass which can no longer be called alveolar.

*b. Endothelial sarcoma* (endothelioma, endothelial sarcoma, and alveolar sarcoma of Wagner and others) *and lympho-sarcoma* (lymphoma malignum, desmoid, lymph-adenoma, etc.) *of the skin.*

When endothelial warts, either from chronic irritation or sometimes even without demonstrable cause, degenerate acutely, rapidly exceed their former limits, and the proliferated cell-masses degenerate, they have developed into a malignant tumor. Soon the neighboring skin and the deeper tissue are implicated, and cords and tubercles of degenerated tissue form by way of the lymph-channels.

But similar tumors, at first circumscribed, arise also independently deep in the cutis or in the subcutaneous tissue. In the beginning they are roundish, tense, connected with the skin, at times tubercular; clinically and anatomically they resemble certain deep epithelial cancers, which first appear as solitary large tubercles, and then ulcerate deeply; or else they are similar to circumscribed deep adenomas or adeno-carcinomas. Among these belong especially tumors constricted at the base, which are smooth, tense, superficially ulcerated, moderately hard, on section glossy, homogeneous, lardaceous, at times also very finely granular or reticulated, white or reddish, in the depth medullary, discharging turbid or even milky fluid, then become of almost creamy consistence, more rarely stiffly caseated into networks and tubercles or hemorrhagic. It is probable that among them belong also subcutaneous tubercles of similar structure, which are diffluent in the centre and enlarge rapidly; furthermore, most of the malignant melanotic tumors, as well as many colossal tumors of the lymph-glands which break through the skin. These tumors are to be distinguished from true carcinomas mainly by their usual occurrence in young persons, by their seat on the lids, in the place of soft warts, by their greater homogeneousness, their more spherical form, sharper demarcation, and looser connection with the epidermis; especially if we exclude from among them such tumors as have been called endothelial carcinomas for no other reason than that their connection with the epidermis or glands could not be demonstrated, or because the branchings of the cell-nests corresponded with those of the lymph-vessels, and their cells showed the embryonal character more than other carcinomas.

In endothelial sarcoma, we often find all possible transitions from formations resembling epithelial nests to diffuse groups of embryonal endothelial cells. In one and the same tumor we see nests filled with large flat or polygonal cells, the seat of which, in lymph-vessels, is easily recognized; then rows and columns of small macro-nuclear,

polygonal, perishable cells, or alveoli closely packed with similar cells, separated from one another by a quite delicate, often elastic stroma. Between the cells we find not rarely fine glossy fibres and networks, as well as coagula, and homogeneous rows of fibres as though formed of cells. More frequent, probably, are forms in which one or other class of cells predominates; for instance, in which peculiarly dendritic gland-like rows with cylindrical cells and concentric nests of flat cells are in the majority; particularly in mixed forms of tumor which have penetrated the skin secondarily, and in very rare cases only have originated there. The most common primary endothelial sarcomata contain moderate sized, homogeneous, macro-nuclear cells in plasmatic channels or alveoli. Purely small-cellular, alveolar forms are rarer.

These forms indeed might be separated, but owing to the many transitional forms, the separation seems hardly practicable. We think we can only set apart, as lympho-sarcomas, tumors formed of cytogenous tissue, in accordance with their clinical and histological appearance, without at the same time failing to recognize that gradual transitions into endothelial sarcomas may occur.

Clinically, however, all these tumors will appear very similar. Lympho-sarcomas, in general, will be still more malignant than the endothelial sarcomas.

Otherwise, in one as well as in the other, the tubercles will progressively enlarge at the expense of the surroundings, young tubercles will appear by the side of the old, and coalesce with them; soon the lymphatic glands in the neighborhood swell, usually into tubercles with medullary softening; then the affection spreads by metastasis to nearly all the lymphatic glands of the body, to the lung, liver, serous membranes, kidneys, etc. Hard and superficial forms, when removed in time, will offer a more favorable prognosis than soft and deeper forms.

A peculiar neoplasm, restricted to the skin (mycosis fungoides, lymphadenoma cutaneum, etc.), appears in the form of various sized superficial tumors, which are due to a complete substitution of cytogenous tissue for the cutaneous structures. This remarkable skin disease often begins with nervous symptoms and erythematas similar to leprosy; these give way to a multiple neoplasm of fungoid medullary tumors, which usually ulcerate deeply and become covered with crusts. One peculiar circumstance is, that, especially in the beginning, the several tumors disappear and give way to a normal formation of skin, while new ones perpetually form, so that the affection on the whole acquires ever larger dimensions, and finally ends fatally. At first, the tubercles are small, and harder than those of subsequent formation; at last we find that the entire integument has become œdematous, and covered with countless, confluent, pendulous, soft, ulcerating tubercles up to several centimetres in diameter. Histologically, the tumor corresponds to our lympho-sarcomata, with all possible transitions of their elements.

It is questionable if we are justified in interpreting these tumors as sarcomas (Cornil), or if, in a concrete case, it is not rather a peculiar granulation tumor we have before us.

A similar disappearance of isolated tumors in a multiple affection of the body has previously been observed with multiple fibromas, and in a case of fatal xanthelasma. The metamorphoses which endothelial sarcomas and lympho-sarcomas undergo are in part those connected with molecular deliquescence into lacunæ, or also with fatty or mucous degeneration, in part those due to abnormality in vascular distribution or arrangement; as such we may mention pigmentation, thrombosis, usually by leucocytes, hemorrhages, and infarctions. The infarcted tissue undergoes a sort of coagulation necrosis, becomes

stiff, caseous, brittle, friable, diffuse, yellow or brown; the tissue appears diffusely saturated with some pigment and indistinct.

We have already mentioned the malignancy of the tumor, and shall only add that, in our opinion, the single tumors, as in the kindred leukæmia, represent merely the local expression of a malignant lymphatic proliferating power over extensive portions of the body. Still, not all lympho-sarcomas are equally dangerous; there are some forms of slow growth, but those occurring in young persons increase with uncommon rapidity and lead to an unavoidable death. Extirpation of the tumors will hardly ever retard the advanced process; internal treatment, especially strong doses of iodine, have in a few recent cases led to an arrest, even a cure of the process. Where the tumors are widely diffused, this treatment is to be avoided as weakening to the organism without retarding the development of the tumors. In such cases, extirpation will often hasten the formation of metastases. Some influence on plethoric lymph-adenomas is exerted by pyrogallic acid (Acidi pyrog., 10 Gms.; Ungt. simpl., 100 Gms.), applied in a thick layer for three days, which destroys the tumor locally. Besides, in these tumors in particular, the main efforts should be directed to the improvement of the general health.

## 2. SARCOMA OF THE SKIN.

Sarcoma occurs most frequently in and beneath the skin.

With Virchow's work came a complete clearing up of morphological conceptions, and he placed in this category tumors which, always vascular, differentiated themselves from other connective tissue tumors by the excessive number and size of their cellular elements and which showed well-characterized forms varying especially in accordance with the local conditions of their situation.

Since Virchow's time sarcoma has hardly been the subject of thorough investigation.

Investigators contented themselves with examining the habitus, the cell-forms, and the vessels of the several tumors, without entering into the more minute structure and their causation. Rindfleisch considers sarcoma as a tumor representing any stage of granulation; Cornil and Ranvier, as a tumor in a stage of embryonal development. But on one point all investigator sare agreed—that the vessels play a prominent part in sarcoma.

In 1877, I described observations from which I abstract the following sketch: By the aid of certain guarded methods of examination of soft, quite recent sarcomata, there were found peculiar, in general solid, bluntly branching islets with bushy offshoots (like willow-trees in winter); they were very numerous and contained vacuolæ which coalesced into larger spaces; within them were several red blood-corpuscles. From the offshoots extended usually respectively two parallel rows of spindle-cells inclosing a canal into which grew the offshoot—likewise solid and provided with vacuoles containing blood-corpuscles—but which was effected with extensive ramifications. The cellular elements of these rows which bordered the canals were often fused together toward the lumen, had become flat, yellowish, glossy; and here too, in vacuoles, yellowish flakes and red blood-corpuscles were encountered. Other islets were as if built up of cells, at their centre the tissue had acquired a yellowish lustre and contained within vacuoles red formations resembling leucocytes. Many tumors were found to be entirely composed of these structures.

Sometimes there were found, besides these, longer, branching islets—similar to those first mentioned—and the end of young blood-vessels also terminated in similar offshoots

and was connected with islets by thin processes or preformed rows of cells. In other cases, there was found, on appropriate treatment (examination when quite fresh, careful maceration with agitation, treatment with hyperosmic acid, eosin or saffranin, also with picro-carmin) a cellular network in connection with the protoplasmatically sprouting vessel-wall; especially large cells or fused cell-masses are connected with the vessel-wall by protoplasmatic processes. The centre of these cells becomes homogeneous, yellowish; within them yellowish flakes again occur. The cavities often open toward one side into a cellular cord which has become hollow and now probably forms the starting-point of vessels. Usually, however, there are developed in the large cells formations which could unhesitatingly be called pale and uncommonly perishable red blood-corpuscles; often merely yellowish or reddish, hyaline roundish, coherent flakes, pigment granules, yellowish discoloration of the interior of the cell, or the formation of empty vacuoles.

As in these cases, so in all recent soft, especially myxomatous, vascular, rapidly growing sarcomas, similar conditions are found, pointing to independent, though often abortive formation of vessels and perhaps of blood.

It is precisely these cells which make up the most essential portion of the tumors, and which, by proper treatment, show, nearly throughout and exclusively, indirect cell-division processes.

Many investigators, however, directly deny that independent vessel-formation is effected in tumors; while other eminent observers recognized such development of vessels and blood in various tissues of the body, *e. g.*, in the subcutaneous tissue. For some time Ziegler believed that he had witnessed the same condition, but subsequently he positively denied this.

From a large number of examinations I became convinced that sarcoma, as stated by Cornil and Ranvier, is a new-formation of embryonal tissue; but, I must add, not such as is analogous to the connective tissue as it appears in the embryo—which is the view of these authors—but of an embryonal tissue in which the vessels and vascular rudiments are excessively developed, and the latter, proliferating in different forms, cause the mode of appearance of the sarcoma; either, 1st, by the rudimentary formation of countless vessels which go on proliferating without developing into complete vessels, which usually connect with pre-existing vessels or may also be isolated, and in which there occurs probably a complete or incomplete development of blood; 2d, by the parietal portions of young blood and lymph vessels (endothelium, media, adventitia, perithelium) proliferating excessively in an embryonal form, developing fasciculi and alveoli, crushing the vessel proper or largely proliferating like papillæ into the lumen and transforming its free channel into vacuoles, semilunar fissures, and cups. I believe, moreover, that the new-formation may be participated in by muscular and nervous elements, particularly of the vessel-walls.

Fig. 66 is taken from a sarcoma of the neck of a girl aged 17.

Under the microscope, the smallest nodules were seen to consist of a network of stellate pale cells with large nuclei and a finely granular intermediate substance differentiated here and there into fibres; also of very large roundish cells (Fig. 66, *g z*) which partly coalesced into large masses of protoplasm. Within them occur yellowish hyaline masses (*h*) and vacuoles containing the formations resembling red blood-corpuscles. Some of these vacuoles open into exceedingly thin-walled vessels or into lacunæ formed by the divergence of tumor-cells (*g z'*). Besides there are found blood-vessels (*b*) encompassed by spindle-cells which are likewise connected with such cells. All these large

protoplasms, such as occur regularly in similar myxo-sarcomas, especially their most recent portions, seem to represent partly aborted rudiments of vessels and blood.

Fig. 67 likewise represents young tissue from a multiple, quite superficial sarcoma of the skin. The several tumors at first sight make the impression of angiomas. One of the most recent tubercles was excised from the living patient.

On thin sections we observe short spindle-cells in a granular, here and there fibrous

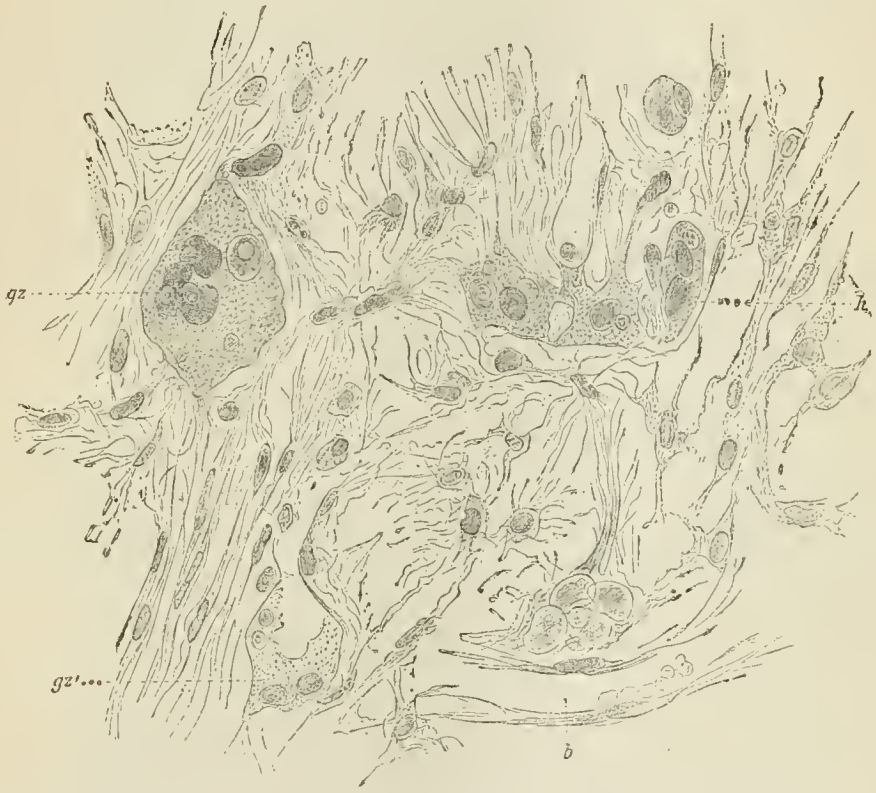


FIG. 66.—SUBCUTANEOUS MYXO-SARCOMA OF THE NECK.—*g z*, large cells (angioblasts ?), partly coalescing. Within them occur yellowish hyaline masses, *h*, in vacuoles. In one of these cells, *g z'*, there is formed a lumen containing small yellowish flakes and opening into a thin-walled canal; *b*, small blood-vessel limited by spindle-cells. It is intimately connected with the protoplasmatic network of the tumor.

interstitial substance. The latter appeared sparser, the cells larger, and in part roundish at the edges of fissures having convex edges. On comparing sections made in different directions, we perceive that these are not canals, but flattened cavities and fissures (*l y s p*) into which the tumor substance proliferates in tumid masses. There are indeed, besides these, plasmatic channels and very similar blood channels into which proliferation has taken place. It is usually assumed that these vessels have no walls. By the ordinary method, the tumor appears but slightly vascular and anæmic, so that the dark color and the evacuated blood remained unexplained. In the body of the cellular tissue are patulous spaces of a different nature, usually lacunæ with concave borders (*s p*), either few blood-vessels with endothelial border, or lymph-vessels with densely cellular, obliterated borders. In their neighborhood there are yellowish-brown, roundish flakes of blood-pigment, and here and there red blood-corpuscles.


FIG. 67.—MULTIPLE SARCOMA OF THE SKIN, PARTLY PIGMENTED AND TELANGIECTATIC (Camera lucida 7): *lysp*, vascular fissures of the tumor into which the sarcomatous mass proliferates; *v*, small vein surrounded by lymph-spaces containing partly endothelia, partly pale red blood-corpuscles, partly pigment; the lymph-spaces are surrounded by proliferated cells containing here and there some pigment; *s*, sarcoma tissue.

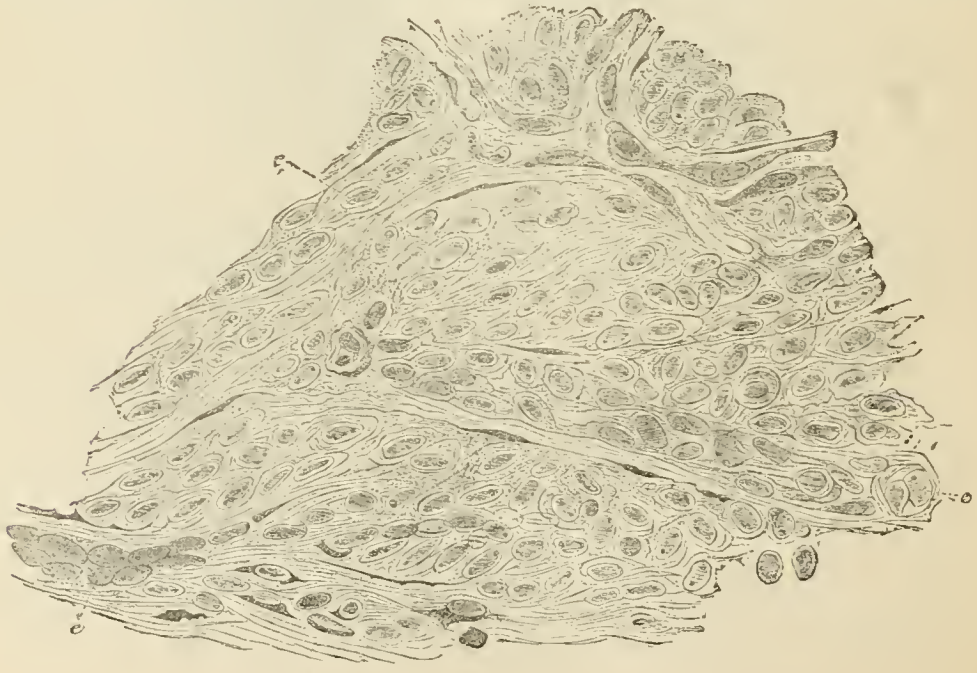

FIG. 68.—PRIMARY ENDOTHELIAL SARCOMA OF THE INTROITUS VAGINÆ.

On treatment with osmic acid, there is made apparent in the tumor a fine, dense, round-meshed network which forms alveoli, on the walls of which are deposited, similar

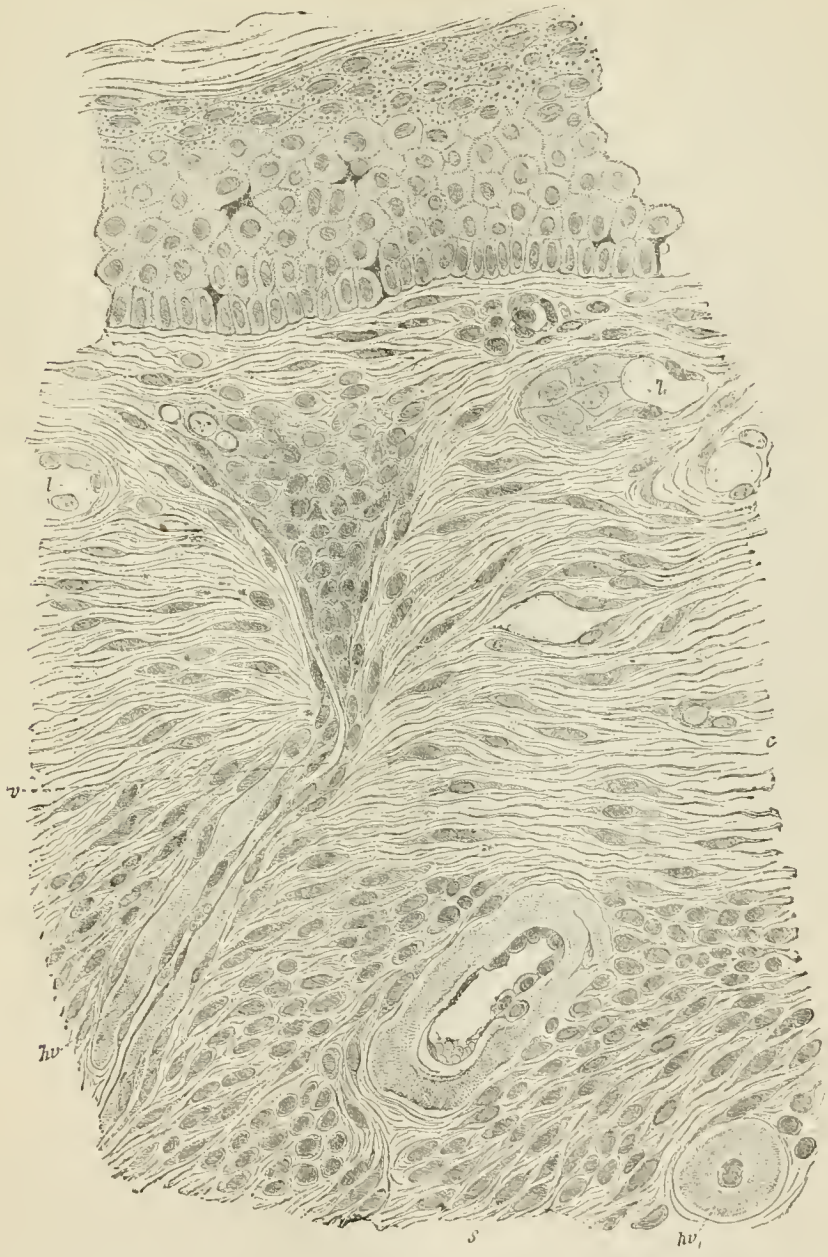


FIG. 69.—PRIMARY ENDOTHELIOMA OF THE VAGINA, WHICH RELAPSED AS A SPINDLE-CELLED SARCOMA: e, atrophic epidermis containing migratory cells; *v*, vein; $hv_1$, hyaline wall of a vessel entering the tumor; *h v*, a vessel entirely compressed by hyaline degeneration of its wall (become "cylindromatous"); *c*, cutis, in its upper layers dilated lymph-spaces, in the depth tendon-like tissue running parallel with the surface and containing numerous cells. Then follows the spindle-celled sarcoma

to endothelium, seemingly fusiform elements. By this treatment, the red blood-cor-

puscles infiltrated into the tissue appear still more numerous, while with other methods they partly melt down and stain the tissue a diffuse yellowish color. Here, then, we have to deal with so excessive a proliferation of the vessels as to form almost the whole of the tumor, the vessels themselves appearing devoid of walls, and as fissures and cups. At the same time, by a certain mode of treatment, a peculiar alveolar structure is revealed in which the spindle-cells act as endothelia. The fact that this alveolar structure became visible together with the youngest blood-corpuscles probably indicates that both formations are similar in quality. The formation of pigment is probably to be explained to a great extent by the escape of red blood-corpuscles, in part perhaps by such as were formed in the tissue and aborted or perished.

Fig. 68 is drawn from a tumor extirpated from the introitus vaginæ of a three-year-old girl. It was situated in the depth of the cutis, larger than a walnut, egg-shaped, freely movable and could be enucleated; it was whitish, softly elastic, almost homogeneously smooth. When carefully examined it proved to be an endothelioma. The entire tumor consists of anastomosing, thin-walled vessels filled with swollen and proliferated endothelia; the vessels appear partly compressed into obliterated cords containing fusiform elements. Between them lie also a few narrow fixed cells of darker color. With low powers the tumor makes the impression of a spindle-celled sarcoma.

Three years after the operation a slightly larger tumor appeared at the same place; it was softer, more lardaceous, irregularly fissured, intimately connected with the skin, and had here and there some shallow ulcers. Microscopically it presented quite a different picture: Fig. 69. The skin over it is thinned, devoid of papillæ; under the epidermis are unusually dilated lymph spaces lined with proliferating endothelia and sparse capillaries; there extended up to the epidermis vascular ramifications ($v$) originating in the tumor, accompanied by large fusiform elements which partly ran parallel with them, partly bent off in the direction of the cutis elements. Perithelial cell material is accumulated in the delta between the ramifications.

The most superficial cutis layer is changed to a tendinous tissue running parallel with the surface, but rich in large elements provided with bushy processes. Where it borders the tumor, these elements bend off along the vessels into the mass of the tumor. The latter consists chiefly of large fusiform elements arranged in cords, or else bordering canals. The blood-vessels are sparse and, excepting the swollen endothelia, have suffered a peculiar hyaline (cylindromatous) change, whereby their lumen appears greatly narrowed ($h\,v$), or even obliterated ($h\,v^1$).

This case permits the very probable conclusion that the spindle-cells may genetically represent an atypical development of endothelia which have been unilaterally compressed especially by proliferation of the vascular rudiments and deprived of their characteristics, or were prevented from developing these altogether, so that the tumor germ, though essentially angiomatous, did not find expression in the formation of vessels.

I may be permitted to add a few brief remarks in substantiation of my views on cell division in sarcomas. 1. In myxo-sarcomas, it is mainly the large cells, which I consider as vessel-forming, as well as very similar enlarged cell-offshoots, which are in indirect division. Within them we often find vacuoles bordered by nuclear filaments. 2. In perithelial (alveolar angio-sarcoma) sarcomas, it is mainly the large cells situated in the centre of the alveoli which are in process of division. 3. When an endothelial wart develops into sarcoma, the endothelioid cells nearest to the spindle-cell tissue show numerous processes of division. 4. In ordinary spindle-celled sarcomas these processes are sparse and affect spindle-cells whose offshoots are connected with young vessels.

The condition mentioned under 3, as well as the manner of embryonal vascularization in endothelioid tissue (probably of lymphatic nature) is shown by an almost gelatinous tumor extirpated from the back and represented in Fig. 70. It consists of sharply demarcated, connected, racemose lobes (*e*) which gave the surface a coarsely granular appearance, and of scanty, superficially granulating interstitial tissue (*i*). The lobes consist of endothelioid cells, usually arranged radially into solid or hollow columns, between which enter thin-walled capillaries and solid delicate cords springing from the interstitial tissue ($i_1$). Where they enter, they are accompanied for some distance by rows of the


FIG 70.—SARCOMATOUS PROLIFERATION OF AN ENDOTHELIAL WART: *g*, granulation tissue of the surface; *b*, superficial blood-vessel bordered by sarcoma tissue; *s*, zone of sarcoma formation by indirect division of endothelial elements; *k t*, figures of nuclear divisions; *w e*, endothelial tissue; *i*, interstitial connective tissue; *e*, penetration of vascular offshoots into the endothelial masses; *a b*, hyaline vascular islets.

most superficial, youngest, spindle-cell layer of the lobes. In the direction of the cords with branches at right angles, but without demonstrable connection with them, there occur equally stained (saffranin), isolated cells which often exhibit vacuoles (*a b*). Near the proliferating surface of the tumor, the endothelioid cells show numerous processes of nuclear division (*k t*), and between them occur in ever denser masses deeply stained spindle-cells (*s*) which at the surface fill the entire lobes and immediately border branch-

ing columns of red blood-corpuscles (*b*). This sarcoma tissue alternates here and there with granulation tissue (*g*).

In this case, as well as in that mentioned at the beginning of this chapter, we can follow the process of sarcoma formation : we recognize in the arrangement of the fusiform embryonal elements, in the continuation of the vessel-buds, the tendency to the formation of portions of new vessels, but which is again made nugatory by cellular individualization and proliferation of the buds.

In numerous other cases, a perithelial proliferation forms the atypical feature of the embryonal vessel-formation, and it would be quite possible to erect different species of cutaneous sarcomata in the directions mentioned ; but this would be of little value owing to the numerous transitions which occur.

Most cutaneous sarcomas are at first isolated, and form spherical, gnarled, lobulated tumors deep in the cutis, more rarely springing from the papillæ. Subsequently, smaller nodules not rarely form in the surroundings. In the beginning, the deep forms are not adherent to the epidermis ; later they become immovably adherent, may ulcerate superficially, and then undergo fungous proliferation. Usually they are but loosely connected with the surroundings, easily enucleated, encapsulated ; not rarely the tumor within the capsule is here and there free, invested with a serous membrane, and even within it are found smaller nodules partly isolated by cup-shaped fissures. On the cut surface, sarcomas are homogeneous or striped, white, sometimes translucent, at times also gelatinous, here and there infiltrated yellowish or greenish, reddish or brownish to black, fissured radially or in lamellæ. They sometimes develop, mainly by central growth, to enormous size. They are frequently congenital, not rarely formed in early youth without demonstrable cause or from warts, *e. g.*, on the lids, the extremities, or the genitals.

As peculiar forms of congenital sarcoma mention might here be made of a tumor the size of a pea, of cartilaginous hardness, from the finger of a three-year-old boy ; it was fungous, intimately adherent to the skin, and consisted of homogeneous hyaline connective tissue and vessel-walls, in which moderate numbers of small spindle-cells were evenly imbedded. A diffuse sarcoma of the foot, the size of a dollar, of a bluish translucence, firmly doughy, flatly prominent, immovably connected with the skin, was removed from a new-born-child. The papillæ here were uncommonly enlarged, and the papillary processes merged so diffusely with the cutis tissue which abounded in dense, short spindle-cells that the lower epithelial limit could no longer be defined. In the depth, the spindle-cell tissue formed homogeneous masses gradually blending with the normal tissue.

Sarcomas of infancy are usually malignant. In adults, sarcomas of the skin generally possess a benign early stage, or else they develop from benign neoplasms, as from warts or benign tumors of the connective tissue.

Not rarely, sarcomas can be traced back to traumatic factors ; *e. g.*, irritation of warts, continued pressure, laceration, wounds, chronic inflammation, cicatrices, and on the toes, malignant onychia.

We frequently find sarcomatous degeneration of granulations, particularly starting from ulcers of the foot ; in such a case roundish or undermined ulcers of the foot rapidly proliferate into deep-red, fungously overhanging loose or firm masses which the microscope shows to consist of round cells, or of bundles of spindle-cells having a radiate arrangement toward the widened surface ; at their ends it is possible to recognize with special facility that the bundles are vessels in papillary proliferation which have embryonal thickening of their walls and narrowed lumen. At times rows of large cells (degenerated rudimentary vessels) traverse the proliferating round-celled granulations, so that

the granulation tissue can still be distinguished from sarcoma, and the latter even be confounded with nests of carcinoma.

Warts give rise most frequently to melano-sarcomas, then to the above-mentioned endothelial sarcomas and transitions into lympho-sarcomas; finally the papillary sarcoma arises from soft papillary warts—sometimes also primarily—in the shape of a coarsely verrucous, firm or carneous, reddish, often fungous structure which usually ulcerates, when a naked, fasciculated stellate or acinous fungous tissue rapidly sprouts forth. Sarcoma faseiculatum is developed from this, or else independently. It is characterized by its peculiarly friable, gelatinous consistence, by pronouncedly fascicular or lamellar fissures, by its translucent appearance resembling macerated fish, by rapid proliferation and extensive superficial degeneration, as well by malignancy. It consists of courses of closely packed, perishable spindle-cells which appear separated from each other by fibrous or granulating interstitial substance, the several bundles—probably vascular rudiments in cellular degeneration—lying on the whole parallel, so that, when cut across, they give the impression of epithelial nests; and, as if to render confusion with carcinoma still more likely, we often find in the depth—especially in tumors developed from warts—and at the point where the fungous proliferation bends away from the normal skin, true epithelial pearls and branching papillary processes. The tumor is often traversed by several hemorrhages which, usually not sharply circumscribed, blend with the surroundings.

Multiple sarcomas of the skin are rare. They arise as superficial roundish nodules, destitute of sharp demarcation, are generally rich in blood and colored. The above-mentioned case would give a good idea of this formation. In other cases there were small spindle-celled forms—hard, flat, smooth, more clearly circumscribed, uncolored tumors which nevertheless progress inevitably, often giving way to soft tumors. In rare cases angiosarcomas and erectile forms were also observed; the latter commencing as points resembling flea-bites, then forming numerous walnut-sized and larger hemispherical, smooth, reddish or livid tumors.

In the subcutaneous tissue, gelatinous, stellate-celled, large sarcomas often arise; but the sarcomas of the subcutaneous adipose tissue are small-round-celled, and are traceable to proliferation of the vessels with preservation of the peculiar lobulated character of this tissue. Cornil and Ranvier distinguish as lipomatous sarcoma a form in which large spindle cells are infiltrated with large drops of fat. They may form encephaloid colossal tumors and become generalized.

Not rarely, sarcomas present mucous or fatty degeneration, hemorrhages, cysts due to the latter or to softening, infarctions with cheesy necrosis and discoloration, colored imbibition, inflammation, and gangrene.

Sarcoma as a rule is malignant in proportion to its softness, the rapidity and peripheral character of its growth, the indefiniteness of its limitation; small, firm, slowly growing sarcomata are more benign than large, soft, colored ones. The more numerous and the smaller the embryonal elements, the more unfavorable is the prognosis, and the sooner do relapses occur even in the small forms and after thorough extirpation, sometimes indeed only after the lapse of years, in the cicatrix; or else, new nodules appear in other places (pleura, lung), probably from tumor thrombi or as the expression of special proliferative power of other locations. Relapsing sarcomas can also be successfully removed subsequently; but as a rule new ones develop even more rapidly and they become softer, more diffuse. The treatment of sarcoma consists in the earliest possible, thorough extirpation.

### 3. MELANO-SARCOMA OF THE SKIN.

*Sarcomata with pigment degeneration, especially of the vascular rudiments.* They form a frequent variety of sarcomas, and usually develop from pigment moles, more rarely primarily.

I have endeavored to trace pigment moles to a great extent to embryonal rudimentary vessels which form pigment instead of blood. I am of opinion that the cavity of new blood-vessels or blood islets arises as a rule with formation of blood-corpuscles, the central part of the blood islets changing into blood, the adjoining part into an originally homogeneous (elastic) membrane, here as well as in the embryo. The young blood-corpuscles are at first pale, larger and much more perishable than the old. When new blood-vessels develop in the adult, they are generally not permanent, and the simultaneously formed blood-corpuscles soon disintegrate or change into pale or hyaline flakes and are soon replaced by those entering from the old vessels. The degeneration of this blood-forming process here consists in an excessive development of similar formations which, however, at once disintegrate into pigment. We are already acquainted with other kinds of one-sided development of vascular rudiments; thus the rudimentary formation of relatively large vascular spaces gives rise to angiomas; that of excessive endothelium, to endothelioma; that of excessive parietal elements, to sarcomas or peritheliomas. And indeed, in melano-sarcoma, several of these excessive formations are present.

The tendency to form an excessive amount of pigment involves also the abnormal chemical constitution of the latter and its rapid granular deposition. The stasis, the "fading" of the blood-corpuscles in the young vessels of the tumor, their size, and their incrustation with them (Gussenbauer) might likewise be traceable in part to the formation of young blood-corpuscles by reason of this tendency. Hyperæmia of the environment may initiate the pigment-forming process, just as it causes many other neoplastic processes. This view is supported in the main by the locations where the pigment is found. We encounter it, in the youngest forms, in enormously swollen endothelioid cells of those small spaces of the skin which, in other cases, are described as plasmatic channels with hypertrophic endothelia, but which represent also rudimentary blood-vessels; we find it furthermore in the wall and in the interior of young vessels of the tumor, and, finally, in vascular sprouts and in perithelial large cells which are frequently in a process of indirect division and form vacuolæ. The pigment appears also in the form of diffuse discoloration; but by careful treatment we may sometimes (see above) even in this stage recognize in the before-mentioned spaces, pale, perishable formations resembling red blood-corpuscles which are soon decolorized or dissolved and give up their pigment to the surroundings. Such formations are sometimes found in giant-cells, in alveoli destitute of clear demarcation, often by the side of giant-cells. We do not intend to deny that, besides the vascular rudiments, other cells, epithelial cells, fixed cells, may form pigment, in which case the mode of origin mentioned elsewhere prevails.

Melano-sarcomas are tubercles which are often sessile on a broad base, fungous, or polypous; frequently they are hemispherical, brownish, livid brown, spotted gray and brown or blackish: they are at first covered with similarly discolored, thinned epidermis, but rarely with kindred papillæ; sometimes they ulcerate superficially and disintegrate into a viscid inky mass, may be moderately firm or fleshy, often become pasty in the centre, range in size from a nut to a fist, usually merge into a black speckled skin, nor are they sharply circumscribed in the depth. On section they appear black or spotted,

usually smooth and moist, exuding a blackish-bloody juice. Sometimes the tubercles arise in the depth of the skin, and in that case usually beneath pigment moles, as roundish, more circumscribed, but otherwise similar nodes, in the surroundings of which we rarely fail to find blackish spots in the glandular and adipose tissue. Soon the latter develop into smaller, more diffuse nodules. Very frequently the tumor now forms metastases or, as I believe, becomes multiple. New nodes continue to form, usually speckled and hemispherically prominent on the surface, more diffuse in the depth. Finally the skin is beset with them and no internal organ is spared. In proportion as the tumors abound in cells and pigment and are soft in consistence, their growth is more rapid. They bleed from ever augmenting vessels containing pigment with blood, often soften throughout into a black inky mass in which no structure can further be recognized. Hardly any tumor is as universally spread or forms as general metastases as does this melano-sarcoma.


FIG. 71.—BORDER AND NEIGHBORHOOD OF A PIGMENT-SARCOMA OF THE ANGLE OF THE MOUTH (Hartn. 4 ; 4): *e*, relatively normal epidermis; *c*, cutis; *p*, black pigment replacing the lower layers of the rete and at *p'* especially penetrating between the cells as far as the surface: *p''*, pigment in the superficial layers of the rete; *h*, hair-follicle on top of a papillary elevation of the skin; *l y*, lymph-spaces of the superficial cutis layer; *p s d*, pigmented sweat-gland, the pigment being present both in and between the tubes; *p b z*, pigmented connective-tissue cells at the border of the tumor; *v p*, elongated papillæ, in part containing plugs of pigment; in one of the papillary processes an epithelial pearl in colloid degeneration; *t*, unusually elongated sebaceous and hair-follicle; *p l y*, tumor tissue, pigment plugs in the lymph-spaces, or the plasmatic channels filled with enlarged pigmented endothelia; *p f g*, pigment in the adipose tissue between the fat-cells.

In most melano-sarcomas the border layer of the thinned epidermis is intensely pigmented (*p*), the pigment may even proliferate through its entire thickness (*p'*), and in the depth surrounds its often hypertrophic papillary processes (at *h*); then, occupying the centre of the papillæ, it forms heaps of cells in place of their vessels (*v p*). The pigment in moles or sarcomas is rarely situated in the cell network between the connective tissue trabeculæ (*p b d*). The tumor is preformed more commonly as a sort of endothelial wart, the alveoli of which are filled or lined with large, often flat pigmented cells (*l y*).

Giant-cells in the tissue, too, contain in their interior pigment or vacuoles with yellowish flakes. The alveoli subsequently become ever denser, the cells within them are compressed into fusiform pigment-cells or homogeneous black masses; the numerous young blood-vessels, formerly replete with pale blood-corpuscles, are now closed by plugs of pigment and surrounded with pigmented perithelia. In the sweat-glands of the neighborhood the vascular network is provided with pigmented, swollen endothelia, and the protoplasm of the gland-cells is pigmented (*p s d*). The same is the case with the vascular network of some fat-lobules (*p f g*). Even in remote regions metastases have established themselves primarily in the vascular network of the smallest fat-lobules or sweat-glands. Of rarer occurrence are cases in which the pigment exists in tumors of a lympho-sarcomatous nature, as well as those in which young vessels in adenomas undergo melanotic degeneration between the tubes or acini. But especially rare are true melanotic epithelial carcinomata in which the pigment, besides being deposited in foci in the connective tissue, occurs mainly as a narrow border of papillary processes in carcinomatous degeneration.

Melano-sarcoma is one of the most malignant tumors, so that the extirpation of the tumor, even when small, is unable to arrest the process. In rare cases only does the tumor grow slowly and without exhibiting the tendency to become generalized. At all events, the most early and thorough possible extirpation of enlarged pigment moles is to be urgently advised.

## 4. ANGIOMA OF THE SKIN.

We apply the term angioma to tumors of embryonal rudimentary vessels which develop into blood-vessels.

1. *Vascular Nævi in General and Simple Angiomata.*

The new-formation of embryonal blood-vessels appears most frequently in the form of moles, the so-called vascular nævi (nævi vasculosi). These subsequently develop into prominent warts and larger tumid formations.

The *true vascular nævi* at first resemble flea-bites, with indistinct outlines;. they are superficial or subcutaneous, usually flat, slightly elevated, and spread slowly; they are connected with the surroundings by means of wide vessels often in form of a spider (nævus aranæus); later they are often more sharply demarcated, wine-red (nævus vinosus), bright red (n. flammeus), or dark bluish-red, moderately salient, mostly uneven spots rising here and there in small grape-like elevations, or form pea- to nut-sized, moderately or deeply lobulated, "mulberry-like" tumors.

The deep, subcutaneous forms are described as tumors of lobulated structure (Schuh); they may correspond to the adipose tissue or to the plexus of veins (lipogenous, phlebogenous forms). They are congenital tumors, from a lentil to a bean in size, have a bluish appearance through the skin (nævi subcutanei), may grow to several inches in diameter, extending into the skin and into the depth; they are lobulated and erectile. They are frequent in the face when single, rarer in groups, and very rare in the shape of countless scattered miliary nodules.

In general, these tumors are soft, relaxed, reddish or livid, very sanguineous, compressible; or they are more rigid, less plethoric, coarsely granular (hyperplastic forms); or, finally, they are lobulated like fat-lobules, in very rare cases resembling a placenta.

The borders of the several forms are not sharply demarcated. The superficial forms are flat or associated with enlargement of the papillæ, of a lighter red; the deeper

forms are usually tumid and darker in color. The epidermis over the tumor is smooth, even atrophic or papillomatous, and is provided with hypertrophic hair-follicles, hypertrophic arrectores pili, and thick hairs. In superficial forms, the papillary vessels especially are dilated, often unusually thickened (angioma hyperplasticum); in other cases, there are wide, rosary-like dilatations of the smallest veins (angioma varicosum). In most cases, however, the new-formed vessels correspond neither to veins nor to capillaries, and form manifold convolutions and networks.

According to Billroth, the new-formation starts first from the capillary plexuses of the hair-follicles, the sweat-glands, the sebaceous glands, or the fat-lobules. Small arteries often lead to the tumor, and dilated, sometimes varicose veins extend thence to the surroundings; within the tumor there are few old vessels, most of them being newly formed. The largely cellular young vessels of the new-born maintain this character subsequently; owing to irritation and perhaps also to nervous influences, vascular proliferation or formation of parietal elements in layers ensues from time to time, and thus the tumor grows. The formation of such an intermediate vascular district causes congestion, vascular dilatation. The blood flows slowly in an angioma, and the latter is not only at times, but constantly more or less swollen. Anger and excitement, as well as undemonstrable causes, may materially augment this condition. Some of the tumors are contractile, on account of the abundance of muscular parietal elements of the vessels and the hypertrophy of the arrectores pili.

The new-formed vessels in simple angioma constitute, in the recent forms, winding, moderately wide, thick-walled tubes with few anastomoses, and invested with swollen endothelia. In some cases it is nothing but the demonstration of blood, often associated with hyaline masses, which enables us to guard against confounding the tumor with adenoma of the sweat-glands. Subsequently the thickening, mainly by concentric deposition of spindle-cells and perhaps also of young muscle-cells, may predominate so largely that the vessels become obliterated, the vessel-walls partly coalesce, and there is presented an appearance resembling sarcoma, the tumor being composed of concentric layers of spindle-cells. In many cases the interior vascular layers suffer a reticular or myxomatous change, while round about the vessel are dense epithelioid cell networks, and nests, probably composed of perithelia. In other cases, the vessels have uncommonly thin walls, and the roundish blood-spaces are bordered merely by swollen endothelia. Sometimes the young vessels have a venous, rarely an arterial character, they are light-red and pulsating. The tissue between the new-formed vessels often resembles granulations, or is composed of embryonal spindle or stellate cells ; later it often becomes firmly fibrous. Through excessive embryonal proliferation of the parietal elements, probably assisted by the interstitial tissue, there may be formed sanguineous, fungous sarcomas (angio-sarcomas). In other cases pigment is deposited in the interstitial tissue and the vessel-wall, probably also in large endothelial cells filling the plasmatic channels.

As above stated, telangiectasias are usually congenital ; small tumors have been observed on the new-born and soon disappear, while others appear soon after birth, grow for some time, and then remain stable. The deep forms especially appear late on the surface ; the tardy forms are rare. Sometimes a small angioma may enlarge uncommonly within a few days. While the telangiectases are generally stable, they at times grow rapidly, so that, in a few years, large portions of the skin may be covered with flat or racemose angiomas.

The causes of simple angioma are those above pointed out ; we shall moreover emphasize the fact that many of them have their seat on maxillary fissures (Virchow's fissural

angiomata) which indicates that supernumerary vessel formation at these places may serve as their matrix. Angioma simplex occurs most frequently on the head, next on the trunk, and on the extremities.

Not rarely, angiomas bleed considerably from small erosions or ulcers. In rare cases they retrogress completely. Central vessels often become obliterated; cicatricial contractions appear in the centre of the tumor, while it spreads peripherally. In other, especially in superficial forms, there is cystoid degeneration of the blood-spaces with hyaline transformation of the contents, probably due to obliteration or occlusion of the vascular connections. These cysts, particularly those originating in papillæ, may rupture.

Sometimes the mole becomes inflamed or gangrenous. Erysipelas may occur in the vicinity of the inflamed tumor. Otherwise these tumors are benign, and, excepting some rare cases associated with itching or temporary twitches of pain (especially in small subcutaneous hyperplastic forms pressing on nerves), are troublesome mainly on account of disfigurement.

For this latter reason, angiomas are very frequently the object of therapeutical, usually surgical interference. We shall make special mention here of the cutting off of the blood-supply of the tumors and the obliteration of their vessels—chiefly by exciting inflammation—but these measures are being gradually more and more abandoned, to give place to removal by the hot iron, thermo-cautery, knife, by cauterization and ligature. Small superficial forms may sometimes be cured by prolonged digital compression, even by the application of ice. But it is best to destroy them by the galvano-cautery, platinum needles being drawn through the base of the tumor and subsequently made incandescent; sometimes ligation is very effective, a needle armed with a double ligature being drawn through the base of the tumor, and tied on opposite sides. Usually, however, these cases are equally amenable to cauterization with nitric acid (applied until the angioma has acquired a yellowish green color), thorough removal by the actual or thermo-cautery, etc.; in the larger forms success can be expected from the latter procedure only. For angiomas on the head over fontanelles, or on the lip, the elastic ligature should be employed with care. In superficial flat forms, cauterization with nitric acid is indicated; in extensive forms, the treatment with hot needles is effective, but tedious.

Very extensive angiomas must be operated on piecemeal, and the result is usually imperfect. In the case of serious hemorrhages of diffuse angiomas, the ligation of large vessels may be indicated.

### 2. *The Cavernous Angioma of the Skin.*

The chief cause of this formation coincides with that of simple angioma; in many cases, cavernous angiomas have formed from the simple variety, by the co-operation of granulation (evidently also embryonal vessel formation), dilatation and coalescence of the vessels (Virchow). In other cases there was preformed a connective-tissue tumor or cicatricial tissue, the atrophy of which distorted the vessels into cavernous spaces (Rindfleisch). Nor is Rokitansky's opinion, that there are preformed cavernous spaces (probably of lymphatic nature) into which blood subsequently entered, devoid of all justification. But there is still another mode of origin. I have illustrated the case of a man affected with general scorbutic disease of the vessels with the formation of petechiæ and proliferation of the gums, in whom hemispherically projecting, smooth, violet, expanding tumors of slow growth, up to the size of a pea had appeared. They bled from the cut surface as if from a fine-grained sponge and collapsed moderately; the cut surface then became bluish red, with firmer, rusty brown points. Examined histologically (Fig. 72), the

epidermis was found atrophic (*a e*), the papillæ elongated only at the borders of the tumor (*p*), the most superficial cutis layer finely spongy by a remarkable dilatation of young capillaries and of plasmatic and lymph-vessels which were in part arranged in cavernous form (*l y*). Then followed exceedingly dilated, in part sacculated vessels which gradually blended with a widely cavernous tissue of the deeper cutis layers, but the tissue on the whole had maintained the direction of the vascular anastomoses. Here and there the stroma between the lacunæ contains smooth muscle-fibres. In the centre of the tumor is a thick-walled thrombotic vessel with indistinct outlines (*k*). Above this point is a callous depression of the epidermis (*s c h*).


FIG. 72.—ANGIOMA CAVERNOSUM FROM THE SKIN OF SCORBUTIC PATIENT (Hartn., c. l. 7): *a e*, atrophic epidermis; *s c h*, callous thickening of the epidermis over the centre of the tumor; *p*, elongated papillæ at the borders of the tumor; *b*, proliferating blood-vessels of the most superficial cutis layers which have become finely spongy, especially by augmentation and dilatation of the lymph-vessels (*l y*); *c*, cavernous tissue, gradually merging into proliferated blood-vessels and maintaining the direction of the deep blood-vessels.

Here the general disease of the blood-vessels had assumed the character of a cavernous tumor. Without being inclined to doubt these modes of origin, I have arrived at the conclusion that there are cavernous tumors which have this character primarily, and that these represent the type in the purest form. Like most vascular tumors in general, these arise from superabundant rudimentary vessels of a circumscribed vascular district. They are large cellular vascular islets as in the area vasculosa, young similar formations of the vessel-wall, or protoplasmatic networks and sprouts connected with them. When abnormally numerous and irregular vessels form from these structures with advance of the vascular proliferation and probably also their union with vascular islets, angioma simplex results; but when the formation of blood islets or of vacuoles is excessively developed in the vascular sprouts, so that consequently merely irregularly connected cavernous spaces result, the walls of which consist only of young endothelia and an elastic membrane, while the archiblastic formations together supply the blood spaces, a cavernous angioma results. A similar process of primarily connecting blood spaces is furnished in the area vasculosa and in many cavernous spaces (corpus cavernosum penis). That many cavernous tumors arise in this manner and not secondarily is shown by the young endothelial lining, the absence of granulation and hemorrhage, the embryonal hyperplasia of the muscle-fibres, the absence of atrophic tissue, and finally the presence of large giant-cells with vacuoles, or of networks of protoplasm connecting with vessels,

in many recent cases. The development of elastic fibres, the crowding out of other elements, the atrophy of the muscle-fibres of the septa, pigmentation and granulation, are undoubtedly effected later as the result of blood stasis in the lacunæ which are unfavorable to the circulation. Through this constant stasis the tumor enlarges, has a bluish appearance, and the blood circulates slowly.

Angioma cavernosum is rarely congenital, but often develops soon after birth, though not uncommonly later. We distinguish diffuse and circumscribed, superficial and deep forms. Fissural angiomas are most frequently cavernous. Usually there appear in the depth of the skin at first bluish transculent, smooth or tumid tubercles, or lobulated tumors which gradually proliferate both outward and into the depth. In other cases the tumor has originated superficially as a nævus and then spreads diffusely over larger portions of the skin. Or the originally verrucose formations, or larger circumscribed superficial mulberry-like tumors, or polypi, grow as such or spread downward into the subcutaneous connective tissue, between the muscles, and into the bones. The transitions into simple angiomas are here so multiple that the differential diagnosis becomes difficult. In general, tumid, bluish, pronouncedly erectile, easily compressible, slowly growing, especially subcutaneous vascular tumors will probably be cavernous. Superficial cavernous angiomas are more prominent; we sometimes notice upon them the lacunæ or groups of them as red points. Encapsulated soft angiomata, which grow very slowly, present no diagnostic difficulties, while hard forms have not rarely been confounded with fibromas, and the lobulated ones with lipomas. Sarcomas, too, being sometimes very vascular, exhibit all the characteristics of an angioma. Even cysts and encephaloceles have been mistaken for angiomas. In doubtful cases, therefore, an exploratory puncture will be always advisable. The extirpated tumor, however, no longer presents any diagnostic difficulty.

The cavernous tumor not rarely is the seat of lancinating pains; sometimes it gives rise to considerable hemorrhages; in other cases some of its points of predilection, the lips or the eyelids, may be so swollen as to hinder their functions and indicate the removal of the tumor.

The treatment of this tumor is on the whole the same as that of simple angioma. As a general rule, in these forms removal by knife and scissors is advisable, in which case the employment of broad hæmostatic forceps and rapid suture will prevent considerable hemorrhage.

### 3. *Lymphangioma of the Skin.*

The term lymphangiectasia has only been employed in recent times for many, usually congenital tumors of spontaneous or traumatic origin having lymphatic canals or cavernous spaces, as well as for cysts containing lymph. In these tumors, there is rather an ectasia than a new-formation of lymphatic channels.

A diffuse form has been repeatedly described as elephantiasis and pachydermia lymphangiectatica, and in one case was said to be due to hypertrophy of the cutaneous muscle fibres (Rindfleisch). Tissues of loose texture, such as the subcutaneous layer of the scrotum, the prepuce, the clitoris, the labia majora, are especially predisposed to the development of such diffuse, tumid, relaxed or swelling formations associated with discoloration of the skin, and with considerable lymphorrhagia after their erosion. Usually we find here, in the depth or in enlarged papillæ, lacunar, connected or ampullary lymph-sacs, together with œdema of the neighboring tissue. In other cases there is present a

similar general hypertrophy of the skin with dilatation of the cutaneous lymph-vessels (Biesiadecki).

*Simple lymphangiectasia, lymphangioma racemosum* (Virchow) is sometimes congenital, either associated with microcephalus or independent, as macrochilia, macromelia, or macroglossia, also on the conjunctiva, and more rarely on other parts. Besides, extensive dilatations of the lymph-vessels arise sometimes in later life. They form swollen or relaxed, vesicular tumors which communicate in the depth, swell under pressure, are sometimes pendulous, diffuse, often intimately connected with the epidermis, and, if eroded, discharge a large amount of serous or milky fluid in which a great deal of albumin and some fat have been found. Sometimes the wide lymph meshwork contains colloid masses, and some forms of cylindroma can probably be traced back to this form (angioma mucosum proliferum, Hirschfeld). A peculiar form has been described by Kaposi as lymphangioma tuberosum cutis multiplex. The case was one of miliary, superficial, firmly elastic nodules with wide lymph channels; they had existed from childhood and some reached the size of a lentil.

In other cases we have to deal with dilatation of the lymph-vessels in lymphatic glands of the inguinal or the axillary region which may lead to greatly swollen tumors, exceeding the limits of the lymphatic glands (lymphadenectasia, Virchow).

Of rare occurrence are partial, diffuse lymphangiomata, usually associated with dilatation and new-formation of blood-vessels. Especially on the foot and leg we observe prominent elastic swellings, covered with pale-reddish skin, which correspond with the course of the lymph-vessels, while the surroundings are tensely œdematous and reddened. At the same time colossal varices may be present. On section we often observe, by the side of thrombotic varices under the atrophic epithelium, a spongy tissue with cavernous spaces containing lymph, and cicatricially degenerated interstitial tissue.

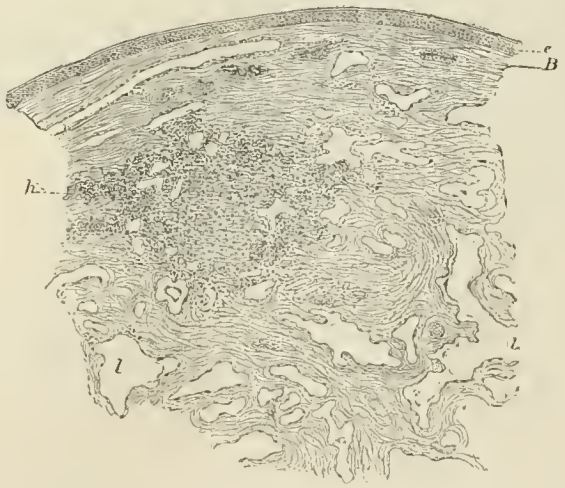


FIG. 73.—LYMPHANGIOMA CAVERNOSUM OF THE CHEEK (Cam. luc., Obj. 4): *e*, atrophic epidermis; *B*, obliterated blood-vessels; *h*, hemorrhagic cicatrix; *l*, rigid connective tissue with cavernous lymph spaces.

Both the general and some diffuse lymphangiectasiæ, as well as those of the inguinal and axillary regions, are much more frequently met with in tropical countries. Some of them may be attributed to the irritation of parasites, such as the sexually mature forms of Filaria sanguinis hominis. In other cases, some preceding injury is the immediate

cause of the affection. There are transitions from this form into very vascular fibromas and sarcomas; also forms in which lymphangiectasia is associated with telangiectasia, and finally transitions into lymphangioma cavernosum. The latter tumor usually constitutes subcutaneous, not sharply circumscribed, soft, even loose swellings which sometimes enlarge moderately, are adherent to the skin, sometimes also at the point of adhesion keloid-like, firm, sometimes projecting flatly, and of moderate extent.

Such a tumor, which was extirpated from the cheek of a girl aged twenty, had formed years before, after a violent blow with contusion of the soft parts, and had grown slowly; it constituted a disfiguring tumor, flat, larger than a dollar, tumidly cicatricial at the centre, somewhat retracted, brown, very firm, hard to grasp peripherally, softly elastic, closely adherent to the skin especially at the centre, and with indistinct borders; its coarsely cavernous tissue discharged an abundance of turbid liquid. On section, the centre was reddish brown, cicatricial, firm. Microscopically the tumor (Fig. 73) exhibited at the centre a firm hemorrhagic cicatrix which was adherent to the epidermis (*d*); while the main mass formed wide connected cavities but partly lined with endothelium, which were separated by a coarse fibrous stroma (*l*) containing trabeculæ of smooth muscle-fibres. The blood-vessels of the tumor were partly obliterated.

The neoplasm did not relapse after extirpation.

The so-called hygroma cysticum colli congenitum is probably partly traceable to lymphangiectasia, but most frequently it is a retention cyst of fœtal branchial clefts, as shown by its epithelial lining. In other cases, *e. g.*, in those of Köster and Winiwarter, in which both endothelial lining and transitions into other evident lymphangiectasiæ (macrochilia) were demonstrated, we are obviously dealing with cystically degenerated lymph-spaces which project mainly at the lateral parts of the neck in the shape of simple or cavernous cysts with clear contents, and which may reach the size of a man's fist. Weinlechner described similar cystic hygromata of the anal region, the axilla, and the extremities, but their origin remained doubtful.

The diagnosis of lymphangioma is not always easy. Simple lymphangiectasiæ may be confounded with deep telangiectasiæ or with lipomata. Harder cavernous forms may simulate fibromata. But the adhesions to the skin and the capacity of swelling will permit the differentiation of these and of cases of soft lipomata. Angiomata can be excluded by the absence of the bluish odor.

The extensive forms, especially the pachydermic or the elephantiasic, may become serious by hindering motion, by ulceration, by lymphorrhagia, or by suppuration. Smaller tumors, even if multiple, present no danger of any kind; they may possibly be painful or sensitive, or enlarge rapidly. Usually they are the subject of surgical interference, especially when situated on the face. Larger, more diffuse forms will soon relapse after partial operation; while the smaller, especially cavernous forms and macrochilia, can be definitely cured after radical removal of the morbid growth. In the same way, cystic hygromata may be made to disappear by puncture followed by drainage, as well as by injection of iodine or alcohol.

## TUMORS APPERTAINING TO THE ARCHIBLAST OF THE SKIN.

Under this head, we shall group together all those new-formations which develop from constituents of the first rudiments of the germ. These can be properly divided into such as form from portions of the external and the internal blastoderm, and such as develop from the median portions of the archiblast, which are early intimately mixed

with the penetrated parablast, build up the muscular and nervous systems, and perhaps also line nervous membranes. In the muscular system, probably its visceral portion, is rudimentarily preformed:

### THE MYOMA OF THE SKIN (LEIOMYOMA CUTIS).

The smooth muscular fibres of tumors always differ more or less from the normal; they are smaller or larger, sometimes contain several nuclei, their cell body is often less homogeneous and lustrous, their nucleus is at times shorter. Nevertheless they can be positively recognized by their form and arrangement, by their peculiar behavior towards acids and bases, but especially by their characteristic yellow color with picrocarmin, and brown color with saffranin, also by the fact that they can be isolated in connection with the elastic tissue of the skin by means of saffranin and caustic potassa.

The origin of myomas in general is probably traceable to the same factors which have been emphasized in the introduction. With regard to myomas of the skin, the following should be stated:

The skin includes three functionally different, extensive layers of muscles, the most extensive of which is probably that forming a constituent of the vessel-wall. Then the arrectores pili form smooth muscular fibres, and finally a third muscular apparatus exists


FIG. 74.—ANGIOMA CUTIS FROM THE PALM OF THE HAND. Picrocarmin and formic acid preparation (Hartn., Obj. 7, cam. luc.): *gm*, smooth muscular fibres springing from (*a*) arterial, venous, or lymph-vessel walls (*d b*); *z i*, swollen endothelium; *b z*, loose, stellate-celled interstitial tissue; *c g*, tissue of the capsule.

in the depth of the skin, especially in the genital sphere (scrotum, labia majora, penis, mammary gland), and in the face in the shape of a thin network of muscular trabeculæ. I have found similar trabeculæ of this tissue inconstantly present in the neighborhood of the anus, the umbilicus, and the ear.

It is from these three layers of muscular tissue that myomas of the skin arise. There are, besides, myomas which penetrate the skin from neighboring muscular parts, or such where detached germs of these parts develop into tumors in the skin, and finally such as are connected with remnants of fœtal formations.

*α. New-formation of smooth muscular fibres of the vessel-wall* occurs with most new-

formations of vessels. We can speak of a preponderance of the muscular new-formation especially in cases where a large proportion of the parietal elements consists of young smooth muscular fibres. Angioma racemosum, too, may suffer uncommon hypertrophy of the muscular elements of the media during thickening of the vessel-wall. Often, however, the opposite condition takes place, the muscle-fibres being crushed by sclerosis of the media, which fact also enters into consideration in the case of other vascular tumors.

Particularly characteristic are very small, subcutaneous, sharply circumscribed, softly elastic tumors (especially on the back, Virchow) which reach the size of a lentil and larger, and are conspicuous by their painfulness. They consist of a coil of vessels in a condition of myomatous degeneration. A subcutaneous myoma of the palm of a young man, in whom the tumor had been noticed even in early infancy, shows this condition in a pronounced form. The tumor was easily enucleated, smooth, invested with a lamellar capsule, softly elastic, on the cut surface smooth, moist, and consisted of a basement substance having a somewhat reddish translucency, and a dense fibrous felted network. The histological appearance of the tumor is reproduced in the preceding illustration (Fig. 74).

Immediately beneath the capsule (*c g*) appears a confused network of convoluted trabeculæ of smooth muscle-fibres (*g m*), on which nuclei are made evident at frequent intervals by treatment with saffranin, and the body of which seems to have serrate borders and flat processes. The muscular fibres are grouped around the axis of trabeculæ, which contain minute clear spaces or cords of smooth or flat, coarsely granular cells (*z i*), which could be easily recognized as endothelia. Immediately around these cell-cords, the muscle-fibres were grouped parallel to their long axis, while the peripheral fibre-layers were usually situated transversely, concentrically, or radially. Between the cords these elements form true convolutions, and they are also found detached, sometimes in the interstitial tissue as trabeculæ loosened from the vessel-wall; the interstitial tissue consists otherwise of few narrow stellate cells, loose connective-tissue trabeculæ, and an almost homogeneous intermediate substance (*b z*); finally sparse plasmatic channels and capillaries course along this intermediate substance. Therefore, it is probable that the tumor sprang from an abnormal vascular rudiment of mainly arterial nature, in which the muscular portion of the vessel-wall furnished the tumor material. Brigide and Marcacci have seen similar tumors, and a lymphangiectatic tumor is described by Axel Key.

*β. New-formations of the cutaneous muscular network* (myomes dartiques, Besnier). They arise as diffuse, solitary, or multiple tumors, especially of the scrotum, the labia, and the mamma. When similar tumors were found at other parts of the skin, I would assume that they developed from trabeculæ of smooth muscular fibres.

Rindfleisch was the first to call attention to a form of lymphangiectatic elephantiasis of the scrotum, in which the smooth muscle-fibres between the dilated lymph-vessels were uncommonly augmented, and on the strength of this observation he ventures the suggestion that this form is traceable to stasis, due to the muscular hypertrophy. In a case of pachydermia in a child æt. three years examined by me, the skin, especially of the genitals and lower extremities, had been from birth tense, wrinkled and warty, brownish, translucent. The epidermis over the folds and warts was thinned, its papillæ thin, far apart, while, in the corresponding depressions, the corneous layer was thickened and the papillæ crowded. On the prominences the cutis is gelatinously homogeneous, containing a large number of lymph and blood capillaries, but otherwise deficient in cells, with few stellate elements. The deepest part of the cutis, which is smooth, contains few glands, and vessels surrounded by a slight accumulation of round cells. By

far the greatest part of this portion, however, consists of a layer of closely packed muscular trabeculæ, each up to 0.3 mm. in thickness, the whole running parallel with the surface of the body and about one millimetre in thickness; they are surrounded by separate connective-tissue sheaths. The thickness of this layer is in exact proportion to the intensity of the process. Better known are circumscribed forms of these myomata which resemble those of the uterus. Förster describes such a case, in which the skin of the scrotum contained numerous small superficial muscular tumors, and a larger pedunculated one; similar structures, whose nature was not determined more closely, were seated in the skin of the abdomen.

Kraemer extirpated from the labium majus of a young woman a large myoma which underwent slight contractions during its removal.

The myomas of the skin of the mamma are somewhat different. In the first place, Virchow describes the case of a man in whom numerous superficial, painful, reddish tubercles had formed, up to the size of a cherry, in the neighborhood of the nipples; they contain, besides dilated vessels, a preponderating mass of smooth muscular fibres (myoma telangiectodes). Verneuil found in a young man, especially on the breasts, flat, lentil-sized and smaller, in the depth pea-sized, reddish, not sharply bordered tumors which had developed painlessly, grew slowly, and later became painful. They consisted mainly of muscular fibres not connected with the vessels, and of a few nerves and striated muscle-fibres, the origin of which it would be difficult to ascertain.

Virchow believes that, in the case of many nævi pilosi, numerous muscular trabeculæ form from the arrectores pili. Balzer also has described a case in which there were numerous superficial, small muscular tumors, especially of the mamma, and which sprang from the arrectores pili.

Hyperplasia of the muscular frame-work has been found even in other tumor-formations. Thus I found this condition in a keloid of the lobe of the ear, in perforating tumors of the testicles, etc.; obviously it is much more frequent (especially in sarcoma) than is generally assumed.

A natural sequence to these cases is formed by those myomas found in places where *normally no muscular frame-work is present.* Arnozan and Vaillard found on the extensor side of the arm countless superficial nodules which spread over the entire trunk, acquired the size of a large lentil, and became painful. The nodules were vascular; they were chiefly made up of independent muscular fibres.

But not all myomas seated in the skin have originated there; in rare cases tumors of parts in the neighborhood of the skin which contain smooth muscular fibres reach under and into the skin; *e. g.*, from the pubo-rectal aponeurosis, from the recto-vaginal septum, from the prostate. Sometimes, too, it may be isolated (detached) germs which have entered the skin and formed tumors there. Marcano describes a case in which from the posterior portion of the labia majora projected a round, easily enucleated, firm muscular tumor the size of an orange which had sprung from the above-mentioned aponeurosis. Probably from the remnant of a branchial cleft, from misplaced germs, there had formed a pigeon-egg-sized fibro-muscular tumor on the lateral region of the neck, round about the narrow invagination of the skin, three cm. in length and beset with numerous hairs. Similar tumors were found under both ears (Klebs).

Myomas of the skin may be grouped according to their origin and appearance, admitting the existence of numerous transitions and combinations.

We can distinguish:

I. *Myomas springing from the vessel-wall* by proliferation of its muscular elements

(*angiomyoma cutis*). They are usually circumscribed and solitary, deeply seated. In relation with the nerves they form irritable tumors (ganglion dolorosum myomatosum).

II. *Hyperplasias of the arrectores pili :*

*a.* As portions of vasculor nævi (Virchow);

*b.* Forming multiple tumors.

III. *Neoplasms derived from the deep muscular layer of the skin* (myome dartique, Besnier):

*a. Diffuse,* as forms of *elephantiasis lymphangiectodes* and *pachydermia myxomatodes ;*

*b.* Circumscribed. This may be polypoid, telangiectatic, multiple, and in the latter case painful.

IV. Myomas which reach the skin secondarily or originate in misplaced germs.

Myomas of the skin are benign, slowly growing tumors, whose variable origin gives rise to different modes of appearance. Sometimes they appear similar to soft or hard fibromas. The location in the genital sphere, perhaps also spontaneous contractility, would lead especially to the supposition of a myoma. The small, multiple, superficial forms might be easily mistaken for sarcomas, but their seat—especially on the mamma—their elasticity, their slow growth, and mainly their painfulness, will permit a diagnosis.

The relative frequency of the latter symptom in the subcutaneous, as in the most superficial forms, finds its explanation, in the former, in their situation by the side of nerves; in the superficial forms, perhaps in an (essential ?) participation of the terminal nerve apparatus which is easily irritated by the spontaneous contractility of the muscular elements.

Myomas which are troublesome on account of their size, location, or painfulness are most rationally removed by operation with the knife or the galvano-cautery, and do not return after extirpation.

# NEUROMA, ADENOMA, EPITHELIOMA MOLLUSCUM, AND CARCINOMA OF THE SKIN.

BY

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## NEUROMA.

VIRCHOW recommended that the term true neuroma be applied only to those tumors which develop from the nervous tissue itself, and are formed of this tissue in great part in their further development. A neuroma is therefore a nervous neoplasm of hyperplastic character.

But this definition does not suffice for all cases. Tumors are frequently found which, in their origin and the primary implication of the nervous tissue, are undoubtedly of a nervous character, but which acquire later such a fibromatous, myxomatous, or carcinomatous nature that scarcely any of the original type remains. At other times, the recognition of the nervous tissue which yet remains is attended with no inconsiderable difficulty, so that the diagnosis cannot be made with certainty.

Despite these objections, we think that Virchow's conception of neuroma should be strictly maintained, in order to avoid the association of growths of different kinds in the same group as neuromata. It seems to me that a tumor, for example, of a fibrous nature, should be called a neuro-fibroma in the same manner that we speak of osteo-sarcoma, myosarcoma, etc

For this reason, we will exclude the consideration of all those homœoplastic and heteroplastic growths in which the nervous tissue plays a subordinate part.

For similar reasons, I will also exclude the so-called painful tubercles, first described by William Wood in 1812. Apart from some unessential peculiarities—that they occur chiefly in the neighborhood of the joints of the upper and lower limbs, particularly upon the smallest cutaneous branches, that they manifest themselves at an advanced age, but may usually be traced back to an earlier period, and that the female sex presents a marked predisposition—the clinical phenomena present such a variety that we will sometimes find the symptoms of neuromata, at other times of fibromata, myomata, and even of cavernous angiomata. From an histological standpoint, we can sometimes

discover in them entering and emerging nerves and an unusual abundance of nerve-fibres; but such appearances may also be absent, and in these cases we find the appearances either of a connective tissue growth, varying from a soft to a cartilaginous structure, or of some other neoplasm.

It may be, therefore, that we are not always able to make a correct diagnosis of painful tubercles, but it is more probable that the term represents a group of cases which have not been sufficiently differentiated, in which event it should not be permitted to represent a species of tumor, but the tubercles of really nervous character must be separated and exclusively termed neuromata dolorosa (Virchow).

Furthermore, I think that the neuroma plexiforme of Verneuil should also not be regarded as a true neuroma. In all the cases (about twenty-five) hitherto described, the nodular thickenings (in places) of the hypertrophied, usually pre-existing nerve plexuses (sympathetic, frontal, and supraorbital nerves, lumbar, sacral, brachial plexuses, etc.) were imbedded in proliferated connective tissue, so that even when the latter did not form a circumscribed prominent tumor, but a diffusely thickened, more or less pendulous fold of skin, its predominance threw the nervous element far in the background. This relation of the two varieties of tissue does not arise gradually in the course of development of the neoplasm, but exists to a certain extent as soon as the congenital predispositions are manifested. In large growths of this kind, we may satisfy ourselves that the tumor in the large proportion of cases is diffuse and passes insensibly into the neighboring tissue, or it is circumscribed, and then incloses a nucleus of varying size. Upon section, it is found that the plexiform tumor is formed of the sum of proliferations of the cutis (corium, subcutaneous cellular tissue, vessels, glands, etc.) or that it is derived immediately from the nerve-fibres, but that the lamellar sheaths of the latter have proliferated in such a manner that they in part separate the individual nerve-fibres entirely from one another, and in part cause their total disappearance.

It is, therefore, not surprising that P. Bruns, Czerny, Cartatz, and others have found, in plexiform neuromata, young and developing nerve-fibres, and that Winiwarter also found muscle-cells in them. Winiwarter has also seen these neuroma nodules transformed into sarcomata.

In my opinion, the growths collected under the term plexiform neuroma should be divided among fibromata, neuro-fibromata, elephantiasis arabum, etc.

*Nature of Neuroma.*—Neuromata of the skin occur either on the trunks, branches, and twigs of the nerves (peripheral neuroma) or upon their terminations (terminal neuroma). They are more frequent on the spinal nerves, rare on the sympathetic. They are composed usually of nerve-fibres (fibrillary, fascicular neuroma), exceptionally of ganglion cells (cellular, ganglionic neuroma). In any event, the latter rarely occur upon the peripheral nerves, and it has not been decided hitherto whether they have not been mistaken for small nodules of nerve-fibres in a condition of irritation.

The hyperplastic fibres of neuromata are either medullated or non-medullated. The former constitute neuroma fibrillare myelinicum (Virchow) and are rare, apart from their occurrence as the result of injury; the latter constitute neuroma fibrillare amyelinicum. In almost all cases, however, both kinds of fibres are found intermingled, inasmuch as the medullated fibres represent an advanced stage of development of the non-medullated fibres.

Both varieties grow very slowly, rarely acquire dimensions greater than a child's fist, and are usually single. As a rule, they are round, though some are of an elongated oval or spindle shape, with a uniform or lobulated surface. They are firm and hard to

the feel, and generally do not become painful for a very long period or even not at all, as they are situated usually upon the deeper, relatively less sensitive fibres. The tumor occupies either the entire nerve (total neuroma), or a portion of it (partial neuroma). In the latter event, it is situated either centrally or laterally.

*Diagnosis.*—Upon section, the neuroma presents a smooth, variegated appearance from the inosculation of the fibres and bundles: it is quite dry and anæmic. Medullated neuromata have a grayish white look and silky gloss, while the non-medullated ones are grayish yellow to yellowish white. The medullated fibres are readily detected upon thin sections which have been cleared up by means or acetic acid or stained with 0.5% hyperosmic acid. The recognition of non-medullated fibres is more difficult, and requires teasing and skilled observation. Remak's fibres are best isolated by carefully teasing the tissue, whereupon a freely anastomosing meshwork of fibres makes its appearance. Upon closer observation, the fibres show a somewhat granular longitudinal striation, with large oval nuclei situated at irregular intervals. Upon being treated with acetic acid, the fibres swell and become transparent, and the nuclei become more distinct. Various other reagents may be used, such as picric acid, followed by picrocarmin, etc., the object being to differentiate the nerve fibres from the connective tissue. Quite frequently, however, Remak's fibres cannot be distinguished from connective tissue and the diagnosis between neuroma and fibroma will remain undecided unless a connection can be demonstrated between Remak's fibres and other medullated fibres or unless entering and emerging nerves can be detected.

*Etiology.*—In a few cases neuromata have been observed in childhood; in others,

Fig. 75 *a*.—Cicatricial Neuroma.

Fig. 75 *b*.—Amputation Neuroma.

people of more advanced age have stated that the nodules were present, though in a latent condition, at an early period of life. This fact, together with the experience that neuromata may be combined with affections of the central organs (idiocy and cretinism or neuropathies of the peripheral nerves) or with a diffuse neuromatosis, though perhaps of a neuro-fibromatous character, justify the assumption that the tumors, or at least a predisposition to them, is congenital. Schiffner, Hitchcock, and others have observed neuromata in various members of the same family; usually, however, neuromata are acquired, either spontaneously or as the result of traumatism. Virchow believes that a predisposi-

tion is engendered by scrofula and phthisis. The large majority of cases, however, are due to direct injuries to the nerves, such as compression, partial and total section, resection and ligature of the nerves, deep-seated ulceration and amputation of the limbs. The neuromata may develop within a few weeks (if a predisposition is present) or only after the lapse of years, either directly at the site of injury or at a distance of 1–2 cm.

It must be assumed that the irritated end of the nerve becomes intimately united with the granulations, and that, when the cicatrix has fully formed, the nodule is intimately united with it, and is often provided with a fibrous prolongation, which constitutes a nidus for the new formation of nerves (Fig. 75 *a*). Or the ends of a large nerve trunk form nodules by uniting with the cicatrical tissue as in the amputation neuroma shown in Fig. 75 *b*, and which are united with one another in such a manner as to form neuromata of plexiform appearance. In exceptional instances, I think that amputation neuromata are due to the combined retraction of the muscles and vessels of the stump.

*Symptoms, Course, and Termination.*—Neuromata may exist for a long time without being noticeable and may not be notably painful, even upon pressure. The interference with nervous function is either sensory, motor, trophic, or psychical in its nature, according to the location of the tumors. As these are situated with relative frequency on the peripheral nerves, sensory disturbances (hyperæsthesia, neuralgia, hypæsthesia, anæsthesia) are most commonly observed. This is particularly true of neuralgia, which is often so severe as to cause the patient to lead a miserable existence, and presents little chance of recovery even after removal of the tumor, on account of the tendency to recurrence. The motor disturbances, which are more infrequent, consist of paresis, paralysis, or temporary or permanent contracture. Trophic disturbances, in the form of eruptions, atrophy of the skin, muscles, etc., may develop either alone or in combination with one or both of the series of disorders mentioned above. With regard to the psychical manifestations, I refer to the remarks under the head of etiology, and will simply add that they may occur at any period during the course of the disease.

The character of the nervous disturbances depends not alone upon the quality of the affected nerve, but also upon its special relation to the neuroma. Thus, a tumor situated on a mixed nerve will produce varying symptoms according as it occupies its whole extent or is situated centrally, laterally, or peripherally, and also according as the nerve fibres are compressed, stretched, etc.

Neuromata grow gradually and come to a standstill as soon as they have reached their limits, viz., the size of a child's fist. When situated superficially, injuries or inflammations propagated from the vicinity may give rise in them to a similar inflammatory process and they may then lead to cutaneous or phlegmonous ulcers and abscesses. More frequently the tumors undergo a retrogressive metamorphosis, viz.: calcification, softening, and fatty degeneration, in consequence of which they feel like resistant nodules, or assume a myxomatus consistence and become cystic if the process occurs centrally. True neuroma never assumes a malignant character.

*Treatment.*—The indications for treatment depend upon the severity of the symptoms, but operative procedure alone offers chance of successful removal. No internal remedy or external application will cause the disappearance of a neuroma. So-called neuromatosis precludes the idea of removing the tumors separately. We must also hesitate to remove large and deep-seated growths, if they do not produce too serious disturbances, because the result is often disproportionate to the severity of the operation, and also because relapses are not infrequent.

In performing the operation, the morbid tissue must be thoroughly removed, but the

healthy tissue spared as much as possible. When the neuroma is situated laterally, it should be peeled off from the healthy portions of the nerve; when it occupies the entire nerve, extirpation or resection must be performed. If the portion of nerve removed is small, conduction may be restored by the new-formed nerve fibres which develop in the cicatrix or by stitches (catgut) passed through the ends of the perineurium. In animals, resected portions of the nerve have been restored by transplantation, but it is undecided whether this can be done in man. In cases in which the excised part is more than 1 cm. in length, there is little chance of a restoration of the statu quo ante.

When neuromata of the limbs become intolerable on account of their size, pain, interference with function, relapses, ulceration of neighboring tissues, etc., amputation often offers the only chance.

Unfortunately, however, the recurrence of the growths in the stump gives rise to renewed intolerable complaints. Relief of such conditions must be sought in the use of narcotics, electricity, cold, warmth, inunctions of belladonna, aconite, hyoscyamus, etc.

## ADENOMA OF THE SKIN.

*General Considerations.*—The glandular organs of the integument may proliferate in various ways, independent of the circumstance whether they are organs capable of function or are merely rudiments left over from fœtal life. If the proliferation occurs in such a manner that the glandular cells and stroma develop together into an independent neoplasm, and the tubuli or acini, together with the connective tissue boundary, retain the typical glandular structure, it will result in a perfectly typical adenoma.

Adenomata of the skin present the same characteristics with regard to development and clinical history as the other glandular formations of an epithelial nature. Microscopical sections show that the glandular elements constitute the greatest part of the tumor, and that, apart from those partial tumors due to hypertrophy of the cells, adenomata arise in the large majority of cases from hyperplasia of the glandular cells. This may lead either to a numerical increase of the elements within individual parts of the glands, or to a growth of solid offshoots of varying length and thickness, which push the surrounding connective tissue before them. If the proliferation extends still farther, these become the source of further similar formations.

If the offshoots remain in this condition, they become detached by the growing connective tissue, and then atrophy after a longer or shorter period of time.

The course of affairs is different when the offshoots contain a central lumen, and the cells are converted into secretory elements. In this event, the entire tumor or a portion of it continues the glandular function so long as this is not prevented by mechanical obstacles, such as impermeability of the duct, closure of its mouth, etc. The adenoma may thus, for a time, maintain the function of the gland.

These tumors may be sharply circumscribed, and appear encapsulated and usually pedunculated, or they may be diffuse and present a tendency to ulceration, relapse, and degeneration. The consistence is moderately firm, varying with the amount of proliferated epithelium, and the size varies from a nut to a fist. They may occur in any part of the body, but usually in those situations in which the corresponding mother gland is generally found.

A permanent or temporary standstill in the growth of the adenoma may occur at any time, often without any known cause. Sometimes the tumor presents obstacles to its own further enlargement by the peculiarity of its proliferation, inasmuch as the

stroma, either on account of a special tendency or a reactive inflammation, forms a massive wall around the glandular portion, and thus prevents its spread in all directions. Such tumors may remain almost unchanged in the body for whole decades.

More frequently, however, retrogressive changes occur in the tissue of the adenoma after its growth is checked. These changes are manifested macroscopically by diminution of size, changed consistence, color, etc. Microscopical examination usually shows a diminution in the size and number of the cellular elements, and also a degeneration of some sort (hyaline, colloid, mucous, fatty, etc.). But none of these changes deserve greater consideration than the cystic form, both on account of its relative frequency and extent. If the secreted contents of the gland or one of the offshoots cannot be discharged, or if morbid products, such as thick, mucous secretion, epithelium cells, etc., are collected and the walls lose their tonus, a cyst is gradually formed, which contains one or more cavities, and, in the latter event, is often converted into a single cavity by the disappearance of the septa (cysto-adenoma).

Adenomata may also grow uninterruptedly from the start, and thus very large tumors may result. Their mere size may cause all sorts of local disturbances, and by the uninterrupted pressure on the neighboring tissues may give rise to severe nutritive disturbances, even to erosion of the bones, etc. If they have pushed so far towards the surface of the integument that this receives insufficient nourishment on account of impaired circulation, degeneration of the tumor will soon be produced. Such ulcerations, when covered with easily bleeding granulations, cannot be readily distinguished from carcinoma.

The conversion of an adenomatous into another variety of tumor is observed usually in those which have existed for a long time and have been steadily growing. At times we are able to demonstrate the causative irritating influence or other constitutional influence; at other times we must be content with the assumption of a diminished resistance on the part of the organism and a thereby induced predisposition to the degeneration in question. Insufficiently as we can explain why an adenoma discontinues its previous regularity and the glandular elements become irregularly arranged and increased—our ignorance becomes still more palpable when we ask, why should the epithelium elements at one time, the connective tissue elements at another time, undergo this or that change into carcinoma, sarcoma, myxoma, etc. ?

Apart from these fortunately rare terminations, adenoma usually pursues a favorable course. Relapses may occur after imperfect extirpation, but they are always of a local nature.

Adenoma of the skin is comparatively rare and Virchow even doubts its occurrence. It may affect either the sebaceous or sweat glands, more frequently the former.

### 1. *Sebaceous Gland Tumor or Adenoma Sebaceum.*

These tumors are found either in the walls of sebaceous and dermoid cysts, or they develop primarily and then maintain an independent character during their subsequent course. The latter variety, which we will now consider, may be found wherever sebaceous glands occur, but chiefly where relatively numerous and large glands, which are often subject to mechanical injuries (scalp, nose, back, etc.), are congregated.

The origin is rarely found in a single gland, though Robin observed such a case on the labia. As a rule, whole sections of glands in one or more parts of the body undergo the hyperplastic process. This renders probable the assumption of a congenital predisposition.

The increase of the glandular substance, usually by proliferation of its elements, may start from any part and, as I have noticed, does not require that the gland be capable of function; the origin may take place in glands which are in a condition of cystic or colloid degeneration. With regard to the further course of the offshoots it must be mentioned that they often persist for a long time as solid, epithelioidal projections interspersed here and there with pearly globules, until, after continued proliferation, an increasing number of sebaceous cells gradually develop and the offshoot assumes the character of the mother structure.

Sebaceous adenomata vary greatly in size. It is not rare to find them as large as a

FIG. 76.—Transverse section (microscopical) of a sebaceous gland adenoma. Oc. No. 1, Obj. No. 2, tube drawn out (Verick).

pea or a hazelnut; some have been reported larger than the size of a fist. If the tumor has started in superficial glands, the general integument will be irregularly raised and assume a papillary or nodular appearance. This irregularity of the surface diminishes with the progress of the proliferation. The shape of the tumor itself is extremely variable and the growth may even extend into the neighboring tissues as a diffuse infiltration. On account of the predominance of sebaceous cells in these tumors, they have a yellowish white or dirty yellowish brown color and are moderately firm to the feel. If the stroma is very rich in connective tissue, the consistence may increase even to that of cartilage. In the smaller ones, especially those which have developed in hairy parts, moderately long hairs or lanugo may protrude from the dilated mouths of the follicles, but disappear in the further course of development.

Upon lateral pressure, comedo-like fatty plugs may be squeezed out of some of the ducts, while dry clumps of epidermis emerge from others. So much more importance should be attached to the possibility of removing such contents of the tumor since experience teaches that neither shape, size, color nor consistence are sufficient to permit a diagnosis and the feature mentioned above may first lead us to a recognition of sebaceous adenoma.

Upon cross-section we may often recognize, at the first glance, two kinds of tissue, viz.: the glandular and connective tissue. The former is yellowish and presents an acinous structure; the latter is darker and sends septa of various thickness into the former, dividing it into larger and smaller lobules.

In the adjoining figure, the acinous structure of the glandular substance is unmistakable. It is also evident that the tumor is formed of larger and smaller glands and their parts (lobules of 1 to 6 mm. diameter), that each acinus has a basement membrane, and each little group a number of terminal vesicles. It will also be noticed that the smaller cells (the majority) are situated deep in the corium or the reticular portion of the skin, and those which are markedly hypertrophied occupy the entire thickness of the skin. The normally formed general integument passes over the highest part of the tumor.

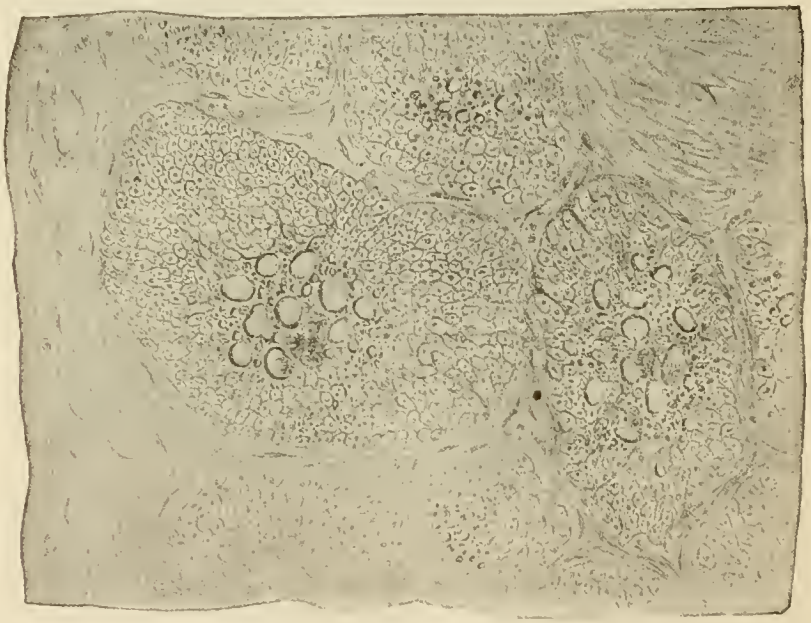

Fig. 77.—Part of an adenoma sebaceum. Oc. No. 2, Object. No. 7 (Verick).

Under higher powers (Fig. 77) it is found that the cells immediately within the membrana propria are compressed laterally, and as they approach the centre become larger and present a marked granular cloudiness. Around the centre, *i. e.*, in the neighborhood of the lumen of the excretory duct, the fat in the cells is often accumulated into large drops, and large cholesterin and margarin crystals are deposited there together with carbonate of lime. The interlobular connective tissue is infiltrated in spots with small cells and contains normal blood-vessels. Bock found no changes in the neighboring sweat

glands, and this I can corroborate; Porta and Broca found the glands in a condition of atrophy or degeneration.

So long as adenomata of the sebaceous glands exist as such, they are noticeable only from their extent. For this reason small tumors may exist for a long time without being noticed and even the larger ones give rise to annoyance only on account of their pressure upon surrounding parts and the feeling of weight. The tumors take the first step in an unfavorable course when they cease to be circumscribed and become diffuse. If they retain the glandular character, the danger consists in the fact that they often attain very considerable dimensions and can be removed, therefore, with so much more difficulty. Moreover, on account of the excessive increase of the epithelioidal elements, the nutritive supply of the tumor proves insufficient and is thus a source of degeneration. But more important than all else is the fact that the adenoma, on account of its tendency to proliferation, forsakes the physiological plan of structure and that, inasmuch as the epithelium cells break through the basement membrane and proliferate in an unrestrained manner, the growth becomes converted into an atypical tumor of malignant character, into a carcinoma, sarcoma, etc. The existence of irritants or long-continued ulceration is therefore not absolutely necessary to the metamorphosis of the tumor, for example into a carcinoma.

Small sebaceous adenomata should be removed, therefore, merely as a matter of precaution. If they are large but circumscribed, the local disturbances constitute a further reason for extirpation. Diffuse growths should always be removed as soon and as thoroughly as possible, without any regard to their size or to the signs of degeneration. Caustics, such as Vienna paste, Canquoin's or Landolf's paste, etc., are not successful. Relapses cannot always be guarded against, even with the greatest of care.

### II. *Sweat-gland Tumor, Adenoma sudoriparum s. glomiforme.*

Lebert first called attention to the fact that a tumor may be formed by hypertrophied sudoriparous glands. But the diagnosis of this variety should be closely criticised, since, from a clinical standpoint, we possess too few data, as a rule, to draw any safe conclusions with regard to the character of the growth. We must also admit that even a microscopical examination quite often furnishes entirely unsatisfactory results, as we will show in discussing the differential diagnosis. But we do not, by any means, wish to convey any doubts with regard to the existence of this form of tumor, in view of the authentic descriptions which have been reported.

Adenomata of the sweat glands may occur in any part of the body, but they have been found chiefly in the face, neck, and back. Thierfelder found a tumor of this kind in the diploë of the cranial bones. On account of the normally more marked twisting of the blind end of the gland in the deepest layers of the corium (thus simulating a small, spherical glandular body), sweat gland tumors have their starting point in this situation and thus require a shorter period to become noticeable, despite their relatively slow growth. They are more frequent in older individuals, but are also met with in childhood. Their consistence, which is harder than that of sebaceous adenomata, is due probably to their location; the large size which they usually attain must also be regarded as the result of anatomical conditions.

These tumors have a dirty grayish white color and an irregular nodular surface. The cut surfaces look somewhat like those of the mammary glands. Microscopical examination discloses tubuli similar to those occurring normally, and also solid prolongations filled with epithelium, bud-like offshoots, which are isolated or pass in an irregular

manner through the stroma. The latter has been pushed into the background. Careful examination of those ducts which are capable of secretion will convince us that their lumen is dilated twofold or threefold, and that their dimensions have increased by increase of the lining epithelium, but that this stands in no relation to the size of the tumor. Observation shows that this is due to the increase in the newly developed tubuli and those in process of development.

As a rule, sweat gland adenomata pursue a favorable course, and usually give rise to no disturbances except those produced locally by their size. In one case reported by Hoggan, it became necessary to extirpate the growth on account of the severe and persistent pains produced by pressure on the adjacent nerves.

The tumors very rarely undergo degeneration spontaneously, but more frequently as the result of injury. Before this occurs, the previously normal tegumentary covering of the tumor is traversed by dilated vessels, assumes a livid red color and gradually grows thinner. Finally a small perforation occurs at the point of least resistance, and the escaping serous, very slightly purulent secretion dries into a crust. If the process continues, the spot of degeneration becomes larger, the secretion purulent and an ulcer is produced with undermined edges and uneven base. This ulcer presents little tendency to recovery, on account of its epithelioidal structure or rather its insufficiency in blood supply. The ulceration, therefore, lasts a long time, but eventually heals and only rarely is it converted into a malignant neoplasm.

Among the numerous forms of retrogressive change undergone by these adenomata, the development of cysts deserves mention on account of its frequency.

In this process the epithelial lining of the glandular tubuli is converted into a mucoid fluid, which is retained and dilates the surrounding walls. The tumors may exist unchanged for years, and, as a rule, are only discovered by accident.

The diagnosis of this variety of adenoma is attended occasionally with considerable difficulty, and I think this is the cause of the differences in their description, and of the fact that they are mistaken for other kinds of tumors. Thus Fuehrer's descriptions and figures show that his cases were really examples of epithelioma molluscum (molluscum contagiosum, Bateman). Lotzbeck's description would lead us to infer that his case was one of nævus vasculosus.

But the greatest caution must be exercised in differentiating this growth from carcinoma; the liability to mistake is so much greater because the same tissue elements are present in each disease.

In a case reported by Domec as adenoma sudoripar., a tumor developed, as the result of a blow, upon the back of a girl sixteen years old, and within a month attained the size of a fist. After several unsuccessful attempts to remove it without operation, the growth was extirpated, but returned and attained the size of a child's head at the end of several months; after being again removed, it resulted in death from cachexia due to metastasis.

In order to avoid such errors, we should not alone take into careful consideration all the clinical factors, but should also direct our attention, in the microscopical examination, to the most recently developed parts of the tumor as well as to the central parts which have formed its starting-point. Offshoots of the sweat-glands may be readily mistaken for carcinoma, especially as the pearly globules, which were formerly considered characteristic of carcinoma, may also be found in adenoma; often, also, only isolated parts of the microscopical preparation reveal the malignant character of the growth by the absence of the membrana propria, the atypical proliferation of the elements, etc.

The same considerations hold good concerning treatment as have been laid down with regard to sebaceous adenoma.

### *Epithelioma Molluscum* (*Virchow*).

Bateman appears to have been the first to describe this disease. In his "Delineations of Cutaneous Diseases" (London, 1817), he recognizes a molluscum pendulum and molluscum contagiosum. He states that the latter is distinguished from other molluscum excrescences by its contagious character and by the escape of milky fluid from an imperceptible opening.

As the clinical appearances differ according to the various stages, some authors have concluded that the molluscum contagiosum of Bateman is a generic term for various forms of anomalies of the skin. The tumor has been regarded as a cystic degeneration either of the hair follicles (Rayer, Virchow) or of the sebacous glands (Hebra, Wilson, Bärensprung), and also as an hypertrophy of the sebaceous glands, the papillary bodies, etc.

The confusion has thus become so great that some writers deny the existence of molluscum as a special morbid entity.

The question of contagion has also added to the confusion. Since the time of Bateman, J. Thomson and Carswell, it was laid down as an axiom that this molluscum is contagious. But other pathologists have found that the growth does not possess this property, and as they did not venture to dispute the original statements, molluscum has been divided into molluscum contagiosum, and then sebaceum, variegatum, atheromatosum, etc. Kaposi proposed that 1. the term molluscum atheromatosum be applied to Bateman's form of sebaceous tumor, atheroma, etc., and 2. the term molluscum verrucosum to the wart-like form.

The original view has not been discarded, however, chiefly on account of the bodies which were discovered by Patterson and Henderson in Bateman's molluscum. It is now recognized that bodies of similiar constitution may also be found in other localities, but never in such quantities that they constitute the main part of the tumor.

Observation has shown that these bodies are not foreign to the organism and consequently are not zooparasites or phytoparasites, but that they take their origin in the place where they are found. Investigations have shown also that, in the numbers in which they are present in Bateman's molluscum, they are never found in the root sheaths or the sebaceous glands; and finally that they are due to a hyaline change and atypical cornification of the cells of the hyperplastic, interpapillary rete. As the assumption of its contagious character is thus disposed of, we think that we may accept the term epithelioma molluscum proposed by Virchow, especially as this takes into consideration both its anatomical constituents and its clinical characteristics.

*Symptoms, Course, and Termination.*—Epithelioma molluscum presents a different appearance according to its stage of development. The most recent tumors are small elevations not entirely unlike lichen pilaris, and escape notice so much the more readily as their color is very like that of the normal skin. If these little tumors are observed more closely, a light, punctate mass is distinctly noticeable at the most elevated portion, and in the larger ones this has increased in size to such an extent that it not alone extends above the surface, but also spreads to the lateral portions. The surface thus presents a deposit which is sometimes thinner, sometimes thicker in comparison with the size of the tumor, becomes uneven, is traversed by yellowish white streaks. It is not

always easy to detach the deposit from its base. For, inasmuch as it is connected with the projections which extend into the interior of the tumor, forms slowly and becomes dry and brittle from contact with the air, it often becomes very difficult to detach little pieces. When present in greater amount it has a pultaceous crumbly consistence, and can be readily removed or is detached spontaneously. In this stage, the surface of epithelioma molluscum may contain a single, trough-shaped depression, attaining the size of a pea at times, with sharp, irregular edges; it is often situated centrally and has been regarded by some as the lumen of a sebaceous gland. Or it possesses several openings, which look as if produced by the point of a needle, and appear to correspond to prolongations that have dropped out. Upon observing the borders of a tumor of medium size, we readily detect an aggregation of individual little nodules like those described above, so that the impression is gained that the increase of the tumor is due not alone to the increase of the elements in the original site, but in part to the addition of new individuals. In this way the shape of the growth changes constantly but, on the average, the fully developed nodules are rounded, moderately retracted at the base, and present, upon the surface, an umbilication which has been formed in the manner described above. The nodules have a pale rose color from the vessels which shine through the walls, and are somewhat shining on account of the tension of the epidermis covering them.

With regard to the size of this growth, I may state that in my case of general epithelioma molluscum, a growth on the penis measured 1.5 cm. in width, 1.8 cm. in length, and 0.5 cm. in height, and weighed 0.5 gm. immediately after removal. But such large growths are exceptional and, as a rule, they do not exceed the size of a pea.

Epithelioma molluscum of the hairy parts of the body deserves special consideration. In the majority of cases hairs are present only on the extreme periphery of the nodule-like neoplasms, so that a casual glance conveys the impression as if the nodules had selected sites between the hairs. But this is not the case; the hairs do not disappear until the proliferation has obtained the upper hand; they persist if the walls of the follicles are protected from its inroads.

After the tumors have reached the height of their development, they may remain in this condition for a long period (a few months to one or two years). When involution occurs, the tubercle becomes flaccid and retracted, and upon exercising lateral pressure, the pulpy contents are no longer extruded, but the readily bleeding papillary body comes into view. Such growths usually drop off upon the slightest mechanical violence.

Another termination consists of inflammation, ulceration, and finally destruction of the growth. In the beginning of the inflammatory stage, nothing is noticeable externally; but pressure causes a milky fluid or consistent pap to exude from the umbilicati on At a later stage the tumor is bright red, œdematous, and warmer to the feel. Pressure discharges a sanguinolent, sero-purulent fluid, containing blood, pus, and molluscum corpuscles. Then losses of substance occur, and gradually increase until the tumor is entirely destroyed, leaving a small, irregular, quite superficial cicatrix.

*Differential diagnosis.*—Epithelioma molluscum is readily recognized; it might only be mistaken for lichen pilaris (which is not persistent), condyloma acuminatum, and molluscum fibrosum. Epithelioma molluscum will only be mistaken for condyloma when the former is devoid of its external deposit and the base of the umbilication has an uneven appearance. It is not difficult to distinguish it from molluscum fibrosum if we remember that its surface is even and its consistence increased. But the most positive

diagnostic evidence is found in the fact that lateral pressure always expresses pap-like contents which contain molluscum corpuscles.

*Anatomy.*—Even to the naked eye a transverse section of epithelioma molluscum discloses a whitish shining, lobulated substance imbedded in a connective tissue stroma. Thin sections of parts in the initial stage of the disease demonstrate that, with the excep-

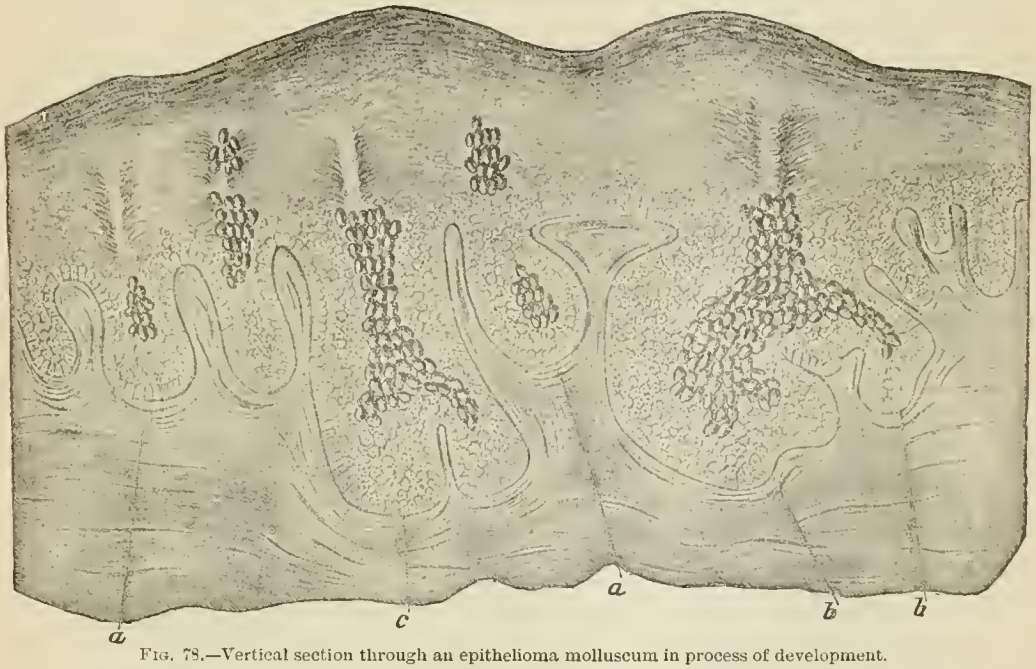


FIG. 78.—Vertical section through an epithelioma molluscum in process of development.

tion of infiltration cells which are scattered through the connective tissue, the principal changes affect the interpapillary rete.

In the beginning its papillæ are increased in all dimensions on account of the enlargement and proliferation of their elements (Fig. 78, *a*). At a later stage, the rete cones send off offshoots (*b*). On account of this formation of offshoots on the one hand and the enlarged size of the individual parts on the other hand, it is often almost impossible to distinguish the starting points of the proliferation (Fig. 79). We may justly conclude, therefore, that the lobular structure of the growth is due to the peculiar manner of proliferation and not to a falsely assumed glandular structure.

The cells of all the layers of the changed rete prolongations are found to have proliferated and increased in size, and to a certain extent arrive prematurely at maturity. In addition molluscum corpuscles are present, and these are often found to begin even in the lowest layer of cylindrical cells. In the lowermost part of the rete they are more or less granular, and may contain a nucleus in the centre or, more frequently, at one side. In the upper prickle-cell layer, they have a compact, homogeneous appearance, and a partly fatty, partly mother-of-pearl gloss. In the horny layer, they are more transparent and their contents more delicate.

Virchow, Klebs, Thin, and others, have regarded the molluscum corpuscles as parasitic in origin, but the majority of observers believe them to be of purely epithelioid origin. But while Rokitansky, Hebra, Kaposi interpret them as parts of the sebaceous

glands, Virchow and Thin regard them as derivatives of the root sheaths, Lukomsky, of the wandering cells, and Bizzozero, C. Boeck, etc., as products of the altered rete cells. I have no doubt that the latter view is correct, and at the present time, the question is, in what manner are the rete cells converted into molluscum corpuscles? Bärensprung believes that they develop from the cells by means of an imbibition of albuminoid fluid. Auspitz thinks they are due to amyloid degeneration, and E. Vidal assumes a colloid degeneration.

Some years ago, Renaut expressed the opinion that the molluscum corpuscles arise from atypical cornification of the rete cells. During his microscopical examinations he noticed that a process of stratification of the protoplasm occurs, starting from the peri-

Fig. 79.—Vertical section through a fully developed epithelioma molluscum.

nucleolar parts of the rete cells. Renaut found that in the beginning of the process an eleidin-like substance is formed, which first changes into a hyaline metamorphosis of the cell body and finally into complete cornification.

My own microchemical investigations have not led to the same results. I have become convinced that the larger number of the altered rete cells pass directly and uninterruptedly into the condition of cornification, and that a smaller number are converted into molluscum corpuscles, after their cloudy, granular contents have changed into a homogeneous, transparent, hyaline substance. Only a narrow zone of the external part of the body of the cell undergoes cornification. The fully developed molluscum corpus-

cles consist, therefore, of two substances, viz., a central hyaline and a peripheral keratoid substance.

*Etiology.*—In view of the fact that among seven cases observed by Bateman, three were children of the same family, and two were servants in this family, and that the mother of a child suffering from molluscum also acquired the disease in the face from contact, this writer concluded that the affection was contagious. Similar cases were also reported by Carswell and J. Thomson. At a later period, the assumption of the contagious character of the growth fell into discredit, but again received corroboration after clinical observations of infection and successful inoculation experiments had been reported, and the molluscum corpuscles were regarded as foreign bodies or phytoparasites. I will now adduce those reasons which have led me, with the large majority of dermatologists, to deny the contagious nature of epithelioma molluscum.

In the first place, I consider as insufficient the proofs which have been brought forward of the genuineness of the results of inoculation. Thus, Retzius narrates that no result had been obtained two months after inoculation, and that this did not occur until at least three months later, in the form of a comedo which gradually assumed more and more the peculiar appearance of molluscum; its contents were found to contain molluscum corpuscles. This single authentic observation, which can be explained in accordance with our views, is opposed by a large number of negative results.

It has also been regarded as proof of contagion that several children of the same family and those individuals who live in close contact, are often affected with the disease. I will go even further and mention that public women often present these tumors on corresponding parts of the body.

With regard to the first point I will recall that children were almost always attacked when several cases occurred in one family. But we know with regard to the integument of the young that it not alone reacts more vigorously to irritants, but that, on account of the remains of the fœtal condition, it is predisposed to proliferations of the horny substance and accordingly of the epidermis. In my opinion, therefore, the fact that several children of the same family are attacked by epithelioma molluscum is due mainly to the tendency in them of the integument to epidermoidal formations.

The following statistics have been gathered by me in a year and a half: Among 576 men I observed the molluscum 21 times, among 313 women 36 times. If those females are excluded who had no genital affection, there were 20 cases of molluscum among 190 women. If, among the latter, we consider only the professional prostitutes, there were 19 cases among 116 females (16.5%). Among men the percentage was only 3.8. It is scarcely probable that this great disproportion would exist, were epithelioma molluscum contagious.

Facts like these have led me to believe that the disease develops preferably upon irritated portions of the skin. Hebra reports a case of prurigo in a boy, whose body presented several molluscum growths as large as a hazel-nut. Cazenave and Schedel describe a number of the growths upon a patient suffering from prurigo senilis (?). Cases of similar import have been observed by Kaposi and myself.

From all these various considerations we must conclude that the cause of epithelioma molluscum is not found in contagion, but in a predisposition of the rete cells to proliferation, and that in a considerable number of cases local irritants act as exciting causes.

*Prognosis.*—The disease has no serious significance for the individual, unless numerous growths develop upon visible parts of the body.

*Treatment.*—It is unnecessary to use any strong local or general remedial agent.

The best means of treatment is the lateral application of pressure to the tumor in order to discharge its contents and thus cause it to dwindle away.

## CANCER OF THE SKIN (CARCINOMA CUTIS).

*Historical.*—The existence of carcinoma had been recognized as early as the time of Hippocrates. Celsus and Galen also give descriptions of the disease. Boerhave, discarding the old view that the bile constituted the materia peccans of the disease, believed that the lymph gave rise to cancer by means of fermentation. Albert Haller, one of Boerhave's pupils, by his experiments and numerous anatomo-physiological labors, first pointed out the way for the investigation of the growth and development of carcinoma.

In 1816 Laennec divided neoplasms into two categories, the first including those which have an analogue in the natural tissues, tumeurs homologues, as distinguished from tumeurs heterologues. The latter included carcinoma, which was distinguished from scirrhus by the primary difference in the elementary constituents.

But it was shown that scirrhus and carcinoma are often found in the same individual and not infrequently in the same organ or tissue. To harmonize this apparent contradiction, Cruveilhier proposed that attention should be directed to the most primary elements, *i. e.*, to the presence of the cancer juice. But this led necessarily to the false conclusion that tumors should not be regarded as cancerous when the intercellular fluid mentioned was absent. Clinicians therefore restricted themselves to a clinical view of the disease and regarded it as a tissue degeneration.

Pathologists, on the other hand, pursued a different course. According to Johann Mueller, carcinoma is neither a heteromorphous nor a heterologous structure; its fundamental histological character is found in the fact that the germinal cells do not arise from previously developed fibres, but from a true seminium morbi, which forms between the cells of the tissue. Cancer is therefore a constitutional disease.

Some pathologists wished to retain the terms homologous and heterologous, not in Laennec's sense with regard to the tissue, but with regard to the formed elements, so that homologous became identical with benign and heterologous with malignant. Lebert goes even further and divides all tumors into homœomorphous and heteromorphous, the latter consisting exclusively of cancer since this contains elements which have no analogue in the human organism. Adolph Hannover has been the most aggressive in favor of the existence of a peculiar variety of cells (so-called cancer-cell).

But the existence of a specific cancer-cell was not generally admitted. Microscopical examinations showed that tumors, whose clinical characteristics were undoubtedly those of cancer, may consist in great part of epithelium, and are thus equivalent in their elementary constituents to Lebert's cancroid and Hannover's epithelioma. It was also generally believed that carcinoma possesses a definite structure, and that the cells with their small amount of intercellular fluid are free in cavities formed by the vascular connective tissue (stroma), analogous to the alveoli of the lungs (Rokitansky, Virchow, Foerster). It remained a matter of dispute whether the cells originated from a specific blastema (Rokitansky, Virchow) or were produced from epithelial germs which had strayed even into places possessing absolutely no epithelium. Virchow and Foerster also gave a more precise definition of cancroid, the characteristic of which they believed to consist in localized accumulations of epidermoidal cells within alveoli of the diseased tissue.

A change of opinion followed in 1855, when Virchow proved that the epidermoid cells of cancroid developed from the connective tissue, and stated that carcinoma in general is a sharply defined form of tumor distinguished by its epithelial character.

But both opinions were not long undisputed. Although cases of primary cancer are observed in situations in which normally no epithelium exists, the followers of Remak and His' exclusive theory of the germinal layers found sufficient support for the view that the elements of such a carcinoma developed from pre-existing epithelium, in the belief that epithelium cells may have wandered or lain stationary in such situations since the embryonic period.

A compromise between these extreme views was made by a number of pathologists and clinicians, who asserted that the cells of carcinoma may be of desmoidal as well as epithelioidal origin (E. Neumann, Perls, E. Wagner, Langhans, etc.).

Many clinicians were dissatisfied with the results of histological examinations, and relied chiefly on the course of the disease. But there are such characteristic differences in the histological relations of desmoidal and epithelioidal tumors (for these are the ones which, for the most part, are mistaken for one another) that we must believe in the validity of the distinction made by Virchow. In tumors of the connective tissue type, we never find such a distinct separation of the cells (round or spindle cells) from the fibrous tissue. Even in endothelioma, in which the cells form veritable plates, and in alveolar sarcoma—in which the roundish cells are often epithelium-like, compressed against one another—thin, brushed sections show that delicate fibrillæ traverse the space left by the removal of the cells. Epithelial proliferations in a connective tissue stroma present an entirely different appearance, and constitute a foreign colony which flourishes at the expense of surrounding parts.

If the clinical phenomena of cancer furnished absolute distinctions, we might dispense with the aid of the microscope, but this is not the case. Among all the symptoms of cancer, there is not a single one, much less a group of symptoms, which is pathognomonic. I do not hesitate to admit, however, that the well-known subjective and objective symptoms are often sufficient to enable us to form a diagnosis.

*Definition.*—I believe, therefore, that we must regard carcinoma as an atypical, epithelioidal neoplasm with a predominantly malignant course, which develops as the result of local disturbances; when the disease spreads, it produces a change in surrounding tissues comparable to inflammation, secondary infiltration of the adjacent lymphatic glands, metastatic nodules in the most various organs and tissues, and finally produces a cachexia as the result of all these changes.

*Etiology.*—If we were in a position to produce carcinoma experimentally as we do inflammation, nothing would be easier than to arrive at satisfactory conclusions regarding its origin. But the observation of its initial stage and progressive spread is attended with great difficulty, as the cancerous process is a chronic and very gradual one.

Clinicians, particularly surgeons, were long since struck by the often multiple occurrence, the great tendency to recurrence, even after early and careful extirpation, and the heredity of carcinoma. These features were explained, accordingly, by a cancerous dyscrasia, a specific blastema. Only in cases in which local irritants were demonstrable as immediate predecessors of the new growth, the thereby resulting hyperæmia was supposed to have caused the exudation of the cystoblastema (J. Vogel).

In opposition to this view, the large majority of pathologists and a no small proportion of German clinicians regard cancer as originally a local affection. In the first place, neither local nor general recurrence of the disease nor its hereditary nature involves the

necessity of its constitutional origin, for otherwise the return of a tumor would not depend upon the repullullation of the tissue and the transportation of the morbific agent, etc., which is opposed by our other experience. With regard to the heredity of cancer, it is well known that not alone constitutional conditions, but even the color of the skin, the condition of the hairs, nails, etc., may also be inherited. On the other hand, the local origin of the disease is testified to by the fact that it usually develops singly, or, if multiple, in one organ or anatomical system, that its development is often attributable to local irritative conditions, and that all sorts of hypertrophic tissues and tumors of a strictly local nature—such as cicatrices, warts, adenomata, fibromata, etc.—may be converted into cancer.

A review of the reasons adduced pro and con., will lead us to decide in favor of the local origin of cancer. The further question now is, under what conditions does it develop?

For some time it was believed that nervous influence played a certain part in the development of cancer, but this view is destitute of foundation.

Nor do we look with favor upon the view that cancer is due to the entrance of an agent from the outside, whether in the form of a contagion, miasm, or any other specific infectious matter. For it is opposed to all experience that a ferment-like increasing substance should require years in order to develop at the point of entrance into an amount appreciable to the senses, that being deposited there it does not become diffuse until certain local conditions have been fulfilled, and that its product, carried into another organism, is not as certain in its effects as the original matter. Numerous negative results have been obtained in inoculation experiments, and but three successful ones have been reported. O. Weber found that a quantity of encephaloid cancerous tissue, introduced under the skin of a dog and a cat, gave rise to a similar proliferation at the point of introduction. Gujon made two successful experiments. In a white rat, in which particles of cancer were introduced under the skin, a carcinoma as large as an almond developed upon the inside of the sternum, the death of the animal taking place two months after the experiment. A guinea pig showed a cancerous nodule at the site of inoculation, twenty-five days after the experiment. But the occurrence of the new growths may be explained by the continuous proliferation of the elements introduced with the mass of tissue or a proliferation per contiguum.

Another hypothesis consists in the assumption that all kinds of mechanical, thermal, chemical, and other irritants, if active for a long time, may produce cancer. Thus, mammary carcinoma is attributed to the injuries received during lactation; cancer of the lip to the action of the mouth end of the article used in smoking, or to the irritating substances contained in tobacco. Pott, Earl Sr., and Desault noticed during the last century that cancer of the scrotum, which occurs almost exclusively in chimney sweeps, is observed only in those who have continued uninterruptedly at the trade for a long time. Recently J. Bell, Manouvriez, and Tillmans have reported cases of cancer of the testis as a result of the action of paraffin vapors and in these patients tar acne eruptions were also present.

If we add that all kinds of chronic ulcers may degenerate into carcinoma, that not alone epithelioidal tumors, but also those of decided histioidal character, may be changed into carcinoma under the influence of persistent traumatism, and finally that the effective irritants are demonstrable even in carcinoma of the internal organs—we possess such an abundance of data for the mechanical, irritative origin of cancer, that it will not appear

altogether astonishing if some regard carcinoma simply as an inflammatory product or co-ordinate with it.

In addition to all these clinical arguments, the histological results materially aid this theory. It is well known that the immediate neighborhood of the growth presents a vascularization and small-celled infiltration of the tissues like that of the inflammatory process, and that these conditions sometimes assume the upper hand to such an extent that the cancerous elements are almost entirely concealed. Waldeyer even goes so far as to raise the question whether chronic inflammatory processes of a local character cannot finally be converted into carcinomatous degeneration.

If this view did not presuppose some lesion or local irritative condition, the absence of the latter in cases of cancer would be less striking. But we will very often convince ourselves that no local factor can be discovered. Cancer of the lower lip will serve as an illustration. As we have seen, this is regarded as the result of continued injury in smoking, either from the mouth-piece of the pipe or the irritation of tobacco juice, or perhaps from the injury received while shaving. But it is notorious that this form of cancer may develop also in women, who are not subject to such traumata. Thus, among 145 cases collected by C. Koch, 13 were females; in 15 cases alone, *i. e.*, 10.35%, did he find a local cause.

This also holds good with regard to other localizations of cancer, and the material collected by the "Congress of German Surgeons" showed that traumata acted as a cause of cancer in only 8 to 16% of the cases.

We must here state that those pathologists who favored the view of a local, inflammatory irritant origin of cancer were aware of the fact that such a cause was not always demonstrable, but assumed that it might be present in another form. Therefore, Virchow, starting from the experience that neoplasms and particularly carcinoma often developed upon a cicatricial, lupoid ulcerated base, enlarged this view into the doctrine that since carcinoma is a purely local disease, it must have a local cause, and this implies that, when such a cause is not demonstrable, a specific, local condition of weakness exists, which leads to the development of the new growth.

Cohnheim has recently advocated the theory that the cause of all tumors must be sought in an irregularity of the embryonal germ. He believes that in a very early stage, perhaps in the developmental period between the complete differentiation of the germinal layers and the complete development of the germs of the individual organs, more cells are produced than are necessary for the organ, so that a number of cells remain unused, but these, though perhaps small in number, possess great power of proliferation on account of their embryonal nature. If this redundant mass of cells is accumulated in one spot, it forms the local germ.

Although no positive proof of this theory can be offered, it is undeniable that a number of circumstances testify in its favor. Thus, it serves to explain congenital cancers. It is also supported by the fact that carcinoma develops preferably in those parts of the body in which, at an early stage of embryonal development, involutions of the external germinal layer occur and therefore irregularities could take place so much more readily.

According to Cohnheim, the outbreak of the neoplasm requires no other conditions than the supply of blood furnished by the normal circulation. This author also believes that traumata, on account of the inflammatory hyperæmia or the weakness produced in the parts around the germinal nidus, may give rise to increased activity and thus aid the development of carcinoma. But the traumata merely act then as exciting causes.

Finally, Cohnheim comes to the conclusion that all the peculiarities of tumors may be explained in a satisfactory manner by this theory.

I have no doubt that of all the theories hitherto considered none will give a more plausible explanation of a larger number of conditions associated with neoplasms, but another series of conditions have not been regarded by Cohnheim and for these he has offered no explanation whatever.

In the first place he does not explain what occurs to the epithelial neoplastic germ in order that, at the end of fifty years perhaps, it may be converted into a carcinoma. Nor does he explain how a cancer develops finally from a harmless ulcer, an adenoma, fibroma, etc., which has already used up its neoplastic germ.

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From the preceding historico-critical consideration of the theories of the etiology of cancer, we must reach the conviction that none of them is entirely satisfactory. My own belief, like that of the majority of clinicians, is that every form of neoplasm requires a specific, predisposed base, in order that traumata and irritants of all kinds, disturbed functions of organs or systems, age, etc., may produce them.

Among the more immediate causes of cancer of the skin we will enumerate :

1. *Heredity.*—This is manifested in two ways. Either the cancer is present at birth or it develops in after-life. The former was long disputed, but Friederich reports a case in which a woman suffering from cancer gave birth to a fœtus with a cancerous nodule in the cutis and subcutaneous cellular tissue above the left patella. Broca found that in one large family sixteen deaths from cancer occurred in the course of seventy years. Sibley gives the proportion of inherited cases as 1 : 10, Lebert as 1 : 12, Velpeau 1 : 8, and Cocke (Report of the London Cancer Hospital) 1 : 7. Experience also teaches that cancer, when it recurs in a family, attacks preferably the same organ or system.

2. *Age.*—Among all the various neoplasms, none is so intimately connected with the retrogressive period of the human organism as carcinoma. This fact has led not infrequently to the exaggerated notion that all malignant tumors of advanced age are carcinomatous. Tanchu found that among 9,118 deaths from cancer, there died

| | | | |
|---|---|---|---|
| Before the 20th year, | 49 individuals. | | |
| From 21– 30 years, | 231 individuals | or | 3.1%. |
| " 31– 40 " | 1,012 " | " | 11.1%. |
| " 41– 50 " | 1,975 " | " | 21.7%. |
| " 51– 60 " | 2,108 " | " | 23.2%. |
| " 61– 70 " | 1,067 " | " | 32.7%. |
| " 71– 80 " | 1,315 " | " | 14.4%. |
| " 81–100 " | 361 " | " | 3.9%. |

The majority of deaths, viz., 67.55%, occur, therefore, from the age of 41 to 70 years. Other statistical tables have not given entirely similar results, for the reason that they included different kinds of cancer.

Gurlt has collected statistics of 11,131 cases of cancer observed in three Vienna hospitals, including 948 cases of cancer of the skin. These occurred, with regard to age, as follows :

| | | | | | |
|---|---|---|---|---|---|
| From 0–20 years, | 12 cases, | *i. e.*, | 1.26%. | | |
| " 21–30 " | 19 " | " | 2.00%. | | |
| " 31–40 " | 96 " | " | 10.13%. | | |
| " 41–50 " | 195 " | " | 20.75%. | | |

| | | | | | |
|---|---|---|---|---|---|
| From | 51–60 years, | 292 | cases. | *i. e.*, | 31.06%. |
| " | 61–70 " | 237 | " | " | 25.21%. |
| " | 71–80 " | 78 | " | " | 8.30%. |
| " | 81–89 " | 19 | " | " | 2.00%. |
| | | 948 | | | |

These results differ to a certain extent from those furnished by other statistics, inasmuch as the average age for cancer is usually at 48.5 years, while that of cancer of the skin alone is about one decade later (55 to 60 years). The essential reason of the occurrence of cancer at an advanced age is still unknown.

3. *Sex.*—The statistics of hospitals usually show a preponderance of the female sex, on account of the frequency of mammary and uterine cancer. In Gurlt's tables, cancer occurred 2,946 times in men, 7,479 times in women, and in 706 cases no sex was mentioned.

But among the 948 cases of cancer of the skin, 739 were males and 209 females. This proportion also is supported by anatomical data, inasmuch as the structure of the male skin, with its more fully developed glandular apparatus, seems to be more predisposed to aid the development of cancer.

4. *Traumatism; mechanical, chemical, inflammatory, specific, and other local irritations.*—We will here reiterate that we are far from regarding local irritants as the sole cause of the production of cancer, though we are not disposed to deny their influence altogether. Their effect is dependent upon the specific predisposition of the skin. When this is present, the carcinoma may develop, after the action of the irritant, upon a previously normal structure, and also in the vicinity of a compression atrophy, in a tissue infiltrated with simple, atypical epithelial proliferation (Friedlander) in a tissue-system presenting phenomena of inflammation or proliferation. The recognition of the latter possibility possesses great diagnostic and prognostic significance, so that we should not be unprepared to find a cancer developing in an ulcerative process, a degenerating adenoma (Verneuil), after caries, etc., even in youthful individuals. Nor will we be surprised that cancer develops preferably in places in which there are permanent disturbances in the anatomical constitution of the tissues. Every physician probably has observed that the dirty gray, so-called sebum warts situated on the temples, forehead, nose or back, the nævus spilus and verrucosus, etc., which are often present since early childhood, gradually become hypertrophied and fissured in later life, ulcerate, and finally become cancerous.

In like manner it is in conformity with the above assumption that cancer sometimes develops in a spontaneous or protopathic cicatrix. But not all tumors of this kind should be regarded as cancerous until they have been examined microscopically and carefully observed clinically. In such cases the origin of the cicatrix should always be determined.

With regard to ordinary lupus the majority of physicians entertain no doubt that carcinoma may develop from it and even from the true lupus tissue itself. The explanation of this circumstance is found in the fact that the irritative condition, which lasts for years, may finally transform the granulation cells of lupus into those of carcinoma.

This leads us involuntarily to the consideration of the question raised by Virchow as to the combination and transition into one another of morbid growths in general. I must answer this question unhesitatingly in the affirmative. For, on the one hand, it has been shown that histioid, organoid, or teratoid tumors, for example, adenoma of the

axilla, which develops particularly in women, sarcoma, enchondroma, fibroma molluscum, dermoid cysts (of the neck), etc., may be associated with carcinoma; and, on the other hand, it has also been demonstrated that the cancerous elements may develop from all types of elements and tissues through the medium of the indifferent formative cells.

5. For some time certain constitutional diseases, such as syphilis, scrofula, tuberculosis, etc., have been regarded as causes of carcinoma. We are not prepared, however, to recognize a direct causal relation between these processes and carcinoma, though they may aid its outbreak and rapid propagation.

6. Nor do we believe that obesity, continuous health, or too nutritive food can be regarded as causes of carcinoma. The proofs of such a relation are entirely wanting.

7. *Telluric and climatic conditions.*—English writers have maintained that cancer sometimes develops more frequently in healthy localities, sometimes in marshy regions, and they have concluded that the character of the soil is an exciting cause. I consider this opinion, also, as entirely unproven.

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Hitherto we have investigated only the causes of primary cancer, and it now remains to explain the mode of development of the secondary process, of the metastatic infiltrations and nodules. Unfortunately, however, there is no agreement of opinion on this point.

The theory of infection was based originally on humoral pathology and assumes, at the present time, that the juices or a substance dissolved in them, or certain corpuscular elements possess in a form of virus the infectious property of producing a secondary process, in the locality to which they are carried.

Gussenbauer assumes that the smallest elements derived from the primary growth are taken up in the protoplasm or nuclei of the cells and thus constitute the first stage of infection. The theory of infection is supported by the occurrence of general carcinosis, the appearance of cancerous nodules outside of the vascular domain of the primary nodule, and their frequent absence in places in which they would naturally be expected. But the theory is opposed by insurmountable objections, such as the complete immunity of cartilage from metastases. The entire symptomatology of the secondary affection also opposes this theory, as is shown by comparing it, for example, with the history of syphilis.

The theory of transplantation is also unable to answer all possible questions, but it nevertheless explains the symptoms in a more satisfactory manner. It explains more readily the fact that the lymphatic glands in the vicinity are first affected, that cellular elements like those in the primary nodule are found not alone in recent thrombi within the vessels, but also in remote parts at the ends of the capillaries (capillary emboli) though no trace of cancer can be found in the surrounding tissues. But the exclusive development of metastases from proliferation of wandering cancer elements does not readily explain their rapid formation; this is easily explained, however, if we assume that the transplanted elements possess the power of causing a proliferation of similar elements in the various tissues.

*Anatomy.*—Cancer of the skin occurs either in the form of nodules, which is rare, or of nodular infiltration. It varies from the size of a pea to that of a walnut or more, is usually of cartilaginous hardness; in the beginning it has a pale rose-red, and later a grayish red, dark red or grayish white appearance, and is traversed by dilated vessels. The surface is even, nodulated, or papillary. In recent cancers of the skin the cut section is pale red, moist and granular; in older ones it is white or grayish white, dry,

fibrous or coarsely granular. The knife passed over it removes a small quantity of a thickish, pulpy, white or yellowish white mass. Lateral pressure causes the appearance

Fig. 80.
Vertical section through a cancer of the lip. Hartnack, Obj. No. 2, Oc. No. 7.

of rounded, elongated, cylindrical depressions or, more properly speaking, in part sausage-shaped plugs, in part whitish or reddish white masses, which are loosened by a serous

or sero-sanguinolent, scanty fluid. Upon the addition of a 0.5 per cent solution of salt, the microscope reveals in these masses a granular, molecular detritus with a few cholesterin crystals here and there, and a large number of epithelioid cells. The isolated cells almost always present the pavement epithelium type; the nuclei and nucleoli are often increased and occasionally cell fission is noticed.

Microscopical examination of the growth should begin at the adjacent healthy tissue. The first deviation noticeable is that the cones of the rete Malpighii gradually become larger (Fig. 80). *a*. Upon close inspection it is found that their peripheral epithelium cells have become cylindrical and are followed toward the centre by larger cubic and rhombic cells or flat, compressed, many-angled cells, etc., provided with spines and dentations. Many of them have one or more distinct nuclei, nucleoli, and occasionally vacuoles. The papillæ and the tissue of the cutis have suffered no noteworthy change. Towards the centre the changes increase. The sprouts of epithelium become larger and send off branches. In the more developed parts, accordingly, are found large, flattened masses of epithelium with branches extending into the corium. *b*. Here and there a sprout of epithelium has spread so far into the connective tissue that, as a result of the inflammatory proliferation in the adjacent parts, it has been separated and converted into a brood nest for one or more cancer colonies. *c*. Careful examination of such places shows that the cylindrical form of the cells is either rudimentary or not visible, but a division of the cells and nuclei is often noticed; the concentrically laminated spheres of epidermis are rarely met with. An irritative condition, followed by proliferation, has been established in the papillæ and corium, corresponding to the changes in the epithelial parts of the cancer. *d*. The result is that sometimes the swollen and infiltrated papillæ project beyond the surface of the skin and divide dichotomously, giving rise to the appearance of carcinoma papillare. Or the irritation, which goes hand in hand with the epithelial proliferation, acts uniformly upon the corium, and then this is infiltrated throughout with round cells; the connective tissue corpuscles are more numerous, the vessels dilated, and the elements of their walls in a condition of proliferation.

There may be all possible transitions from the above-described simplest form to that variety which takes its origin either from the deeper layers of the corium, the subcutaneous connective tissue, or from the glands of the cutis, and which spreads into the muscular tissue as far as the bones. Macroscopically this variety often forms large nodules, of a rosy to dark red appearance, which are usually moist or juicy on cut section.

Under the microscope the beginning of the pathological change is manifested by a scanty round-cell proliferation in the connective tissue, so that a gradual increase of cells is observed in all the epithelioidal parts (interpapillary rete, sebaceous glands, root sheaths, and sweat glands). The histological changes become more striking as we approach the neoplasm. The epithelial cones are more enlarged than in the superficial variety of cancer, and present numerous dendritic ramifications. If the process has started in the epithelioidal structures of the skin (glandular carcinoma), these undergo such changes as to become unrecognizable; the membrana propria is perforated by the proliferation which spreads in all directions into the neighboring tissues. The connective tissue stroma sometimes disappears almost entirely from the pressure of the proliferated epithelium, sometimes in consequence of the irritation it is infiltrated with round cells; in addition the connective tissue corpuscles present various stages of proliferation, the blood-vessels are dilated, and their walls in a condition of irritation.

The most distinct appearances are visible in the cancerous focus itself. Here the proliferation of the epithelium predominates to such an extent that nothing is seen

but the proliferated epithelium alternating with connective tissue in various stages of irritation. The former usually assume a rounded form, but in addition there are some cancer bodies composed of irregularly grouped cells, others which present dendritic ramifications, and still others which assume polygonal, elongated shapes, or pass into irregular streaks.

One of the most frequent variations of form resulting from the mutual relations of the cancer nests to the stroma, develops when the former, while continuing to proliferate, become isolated and situated in the interspaces (alveoli) of the latter. But this isolation is not absolute, inasmuch as the concentric globes often maintain their connection with one another over a wide extent, and in this way the connective tissue forms an interlacing network.

The alveolar structure has been regarded as a special diagnostic feature of this neoplasm, but it is also found in other forms of tumor (adenoma, sarcoma alveolare, etc.).

Not alone does the connective tissue constitute a supporting frame-work for the cancer cells and bodies, but by its blood-vessels and lymphatics it also supplies their nutrition, and thus exercises an often decisive influence upon the progress of the tumor. Newly formed vessels are always found at the site of maximum development of the cancer. Very vascular cancers of the skin run a more rapid course and are less amenable to treatment.

To complete the previous details, we must mention that deep cancer of the skin may spread to all the tissues underneath the subcutaneous connective tissue, thus giving rise in part to a cancerous metamorphosis of these tissues, in part to hypertrophy or atrophy of them. The cancerous bodies press forward into the interstitial spaces, causing an embryonal cell proliferation in the stroma, which then changes into cancerous tissue, or the pressure and irritation cause hypertrophy or atrophy of the neighboring tissues, so that the adipose cells, muscular substance, nerve fibres, etc., are finally destroyed by fatty, granular degeneration. As a result, the bones of the skull, jaw, shins, etc., may be perforated and destroyed.

Hitherto we have considered the anatomical structure of cancer of the skin in general, but more detailed investigation shows that it presents a considerable variety of conditions. In the variety known as carcinoma simplex, the mass of cancer cells is approximately equal to that of the stroma. In carcinoma medullare, the epithelioid cells predominate over the stroma; sometimes the stroma is reduced to a minimum or has entirely disappeared in places. Waldeyer also described an adenoid variety of cancer, which consists of tubuli-like "concentric bodies" imbedded in alveoli which are infiltrated with small cells. This may be mistaken for sweat gland cancer, but the tubuli of the latter are always narrower and convoluted, and the external cells more cuboidal.

In atrophic, cicatricial cancer of the skin (carcinoma atrophicum), the stroma may attain such dimensions, if spontaneous recovery occurs, that the "concentric bodies" disappear entirely or almost entirely, and the entire new-growth is composed of dense, firm, shining connective tissue with some elastic fibres. This variety has long been known as scirrhus.

The usual appearance of the stroma may also be changed by the exceptional increase of its cellular elements. If this excessive proliferation affects the round cells, it gives rise to a carcinoma granulosum; when many spindle cells are present, to carcinoma sarcomatosum. When pigment granules are present in large amount in the various cells and intercellular substance of the cancer, it is known as carcinoma melanoticum. This

form is rare and its diagnosis must be made cautiously on account of the relatively greater frequency of sarcoma melanodes.

The number of vessels in the stroma may also vary greatly; in rare cases, they are almost entirely absent, and in soft cancers the new-formed vessels may constitute the major portion of the stroma.

Other variations in the character of the growth may be the result of retrogressive changes. One of the most common is the cornification of the cancer cells, which sometimes involves whole alveoli (carcinoma keratoides). The epithelium becomes laminated like the layers of an onion (pearl globules, epidermic globules). Carcinomata in which this process is far advanced, feel hard and dry, and the cut section presents a white, shining, homogeneous appearance or a delicately streaked, fibrous surface.

Fatty degeneration is found in almost all old cases of cancer of the skin, either associated with the change just mentioned or existing separately. It is always circumscribed, confined either to a few cells or to one or more foci. If this degeneration takes place in a cancerous nodule situated upon parts which are predisposed to the development of certain tumors, for example, upon the scalp, it may be difficult to decide whether the starting point is a primary cancer, a cyst, etc.

Mucoid softening, ossification, and partial or total calcification constitute rare degenerations of cancer.

Suppuration and ulcerative destruction of cancer of the skin will be discussed under the caption of "course and termination" of the disease.

*Histogenesis.*—In 1855 Virchow, after having shown that a number of tumors were formed from the connective tissue corpuscles, enunciated the theory that the epidermoidal elements of cancroid could also be traced to the same source. In consequence of some local irritation or of some condition of weakness of the tissues the connective tissue corpuscles were said to undergo proliferation and lead to the development of a primary cancer. After this had developed, the cancer cells, which were "carriers and producers" of the specific virus, acted as infecting agents to spread the disease to the immediate vicinity, the adjacent lymphatic glands, and remote organs.

Supported by the clinical and microscopical investigations of Foerster, C. O. Weber, Paget, Billroth, etc., the theory of the connective tissue origin of cancer soon became the dominant one.

Not until Thiersch, after reporting upon 102 well observed cases of epithelial cancer of the external skin, brought proof that the tumor developed from the direct proliferation of the epithelial elements, was investigation directed to all sides of the question.

This theory was sustained by the following fundamental views which were regarded as incontrovertible. Since the time of J. Mueller it had been assumed "that the finest elements of carcinoma tissue were not essentially different from the tissue elements of benign tumors and the primitive tissue of the embryo" and also that the formations of one germinal layer did not permit a transition into those of another. It was also known that in certain forms of typical proliferation (adenomata, warts, etc.) the interpapillary rete and also the epithelioidal elements of the cutaneous glands increase without any notable implication on the part of the connective tissue. It was therefore taken for granted that an epithelioidal proliferation could take place under pathological conditions to the exclusion or with the implication of the other tissue elements. If this is so, there is no objection to the view that epithelial cancer develops only from pre-existing epithelium. With regard to the occurrence of primary cancer in organs which possess no epithelium,

Thiersch believes that this is sufficiently explained by the aberrant occurrence and subsequent proliferation of epithelium in such places.

Waldeyer arrived at the conclusion, in opposition to Thiersch, that there are not different forms of cancer, but that cancroid, epithelioma, alveolar carcinoma, etc., are identical, that carcinoma is only derived from pre-existing epithelium. He had not observed a single authentic case of primary carcinoma of the lymphatic glands, bones, spleen, vessels, in short of such organs in whose structures derivatives of both epithelial germinal layers do not enter.

But the majority of authors have adhered either to the view of the connective tissue origin of cancer or believe that it may be derived both from the former and from epithelium.

Two years after the appearance of Waldeyer's work, Koester endeavored to show that carcinoma is the result of endothelial proliferation of the lymphatic vessels and that the connective tissue only contributes to the proliferation during the later stages. He was led to form this opinion for the reason that the dichotomous ramifications of the cancer bodies often reproduce the appearance of the lymphatic network situated in the cutis, that the alveolar spaces of cancer look like the results of an epithelial proliferation in the lymph spaces, that the original endothelium is absent in the lymphatics which are in contact with the cancer, and finally that there are transitional forms between the endothelium and the cancer cells.

Koester's views have received few adherents, although some writers believe that the endothelium, on account of its close relations to the connective tissue type from an embryological standpoint, may be regarded as a special source of carcinoma.

In a truly classical work published by Waldeyer in 1872, this writer endeavors to show that modern embryological conceptions oppose the view that neoplasms of similar structure in one and the same organ should take their origin at one time from this, at another time from that tissue element, while experience shows that the original kind of epithelium is retained. He also attempted to prove that the epithelium cells possess the same power of proliferation by endogenous cell division, fission, etc., as the connective tissue corpuscles. Furthermore among the two hundred tumors examined by him the epithelium-like groups of cells were always connected with pre-existing epithelium, nor did he ever find any transitions between the wandering cells or other forms of cells and epithelium. He also states that, with the exception of one doubtful case, he has observed no primary carcinoma of a non-epithelial organ, and believes that Thiersch's hypothesis of aberrant epithelial germs will explain the few authentic cases of this character.

Let us consider somewhat critically the grounds for the theory of the exclusively epithelial genesis of carcinoma.

The arguments in favor of this view are both positive and negative. The former prove that proliferations of epithelium are capable of producing neoplasms; this is acceded by most pathologists and clinicians.

The case is different with that portion of the argument which denies the immediate implication of the tissue of the middle germinal layer in the production of cancer, inasmuch as an entire series of appearances testify that the epithelioidal cells of carcinoma also take their origin from fixed connective tissue corpuscles, endothelium, muscle cells, etc.

The borders of thin sections of cancer undoubtedly show "a sharp boundary between the epithelial foci and the surrounding granulation cells," but the profusely proliferating

parts often show places in which this differentiation has entirely disappeared, and in which it is very difficult or impossible to distinguish the quality of the individual cells. Not alone is it often impossible to state which are epithelium, which are granulation cells, and which will become and remain the one or the other variety, but even the fully formed epithelium cancer cells present such a manifold character as regards size, shape, etc., that we are led to question whether they are really derived from epithelium. All these conditions are readily explained if we assume that the various types of tissue are capable of producing embryonal cells, which, under certain circumstances, may be converted into epithelioidal elements. This is shown very clearly in the drawings of microscopic sections furnished by Rindfleisch, Gussenbauer, C. O. Weber, and others. Embryology also furnishes a weighty support to this theory. The most recent embryological studies have shown that in the first period of the formation of the ectoblast and endoblast, and also of the mesoblast derived from the latter, embryonal cells are imbedded between the primary epithelial boundary lamellæ, and that these, in combination with some of the archiblastic elements, develop into connective, muscular, and nervous tissues, blood-vessels, and blood. In this event, there can be no absolute differentiation of connective tissue from epithelium, etc.

From all these considerations, it appears more plausible that all the tissue elements involved in the carcinomatous process first pass into a condition of embryonal cell formation, and that these, according to the individual predisposition of the affected organ, are converted in a great measure into atypical proliferating epithelium, to a slight extent into connective tissue corpuscles, etc., and thus finally give rise to the complete clinical and histological picture of carcinoma.

*Symptoms, Course, and Termination.*—Cancer develops either upon the normal skin or upon that which is changed by a pathological process. In the latter event, the neoplasm may develop from the elements of the morbid products, *i. e.*, those of a lupoid, syphilitic affection, of an idiopathic, irritative condition, of various types of new growths (adenoma, etc.), or it may develop in the integument which has been rendered atrophic, cicatricial, etc., by the morbid process in question. All these features possess no inconsiderable influence upon the course of the cancerous affection.

At the beginning, cancer of the skin presents either a circumscribed infiltration or a nodular form, and in both cases it may attain dimensions of extremely variable proportions. Smaller tumors are usually situated superficially, the larger ones are generally situated more deeply from the beginning. Although all cases pursue the same general course, *i. e.*, a tendency to unrestrained growth followed by softening and degeneration, nevertheless there are certain differences. For example, superficial cancer, as a rule, remains in the upper layers of the cutis, requires a disproportionately long time for its destructive process, and only exceptionally involves the lymphatic glands, and gives rise to metastases. A carcinoma in the subcutaneous connective tissue is often accompanied from the beginning by ominous phenomena. On this account, cancer of the skin has been divided into the superficial and deep varieties.

Cancer of the skin, if not situated upon parts exposed to view, may exist a couple of years or more without attracting the attention of the patient. More observant patients first notice that the little pimple does not disappear, that the crust upon it is continually renewed, that constant itching is present. More attention is paid to it when the patient notices its constant growth. The physician then observes that the process has a chronic look, that despite its long continuance it presents an elevation of scarcely a few millimetres, that the removal of its crust reveals an eroded, readily bleed-

ing, slightly excavated surface, and that it possesses a firmness or hardness disproportionate to its small size. This condition may continue unchanged for many years, and finally undergo progressive or retrogressive changes. In the latter event, the proliferated epithelioidal cells undergo granular degeneration, and are then absorbed, so that when the process has run its course, an atrophic portion of the skin remains, surrounded by a slightly elevated border. If all the cancer cells have been destroyed or are surrounded by the constricting connective tissue in such a manner that they are unable to develop further, the entire process must be regarded as extinct. This occurs quite frequently, at least in places, in old people.

But if a few of the cancer cells retain their capacity for proliferation, a condition again develops which is similar to that existing before the atrophy occurred. When this has taken place, a similar retrogressive process may again develop or the carcinoma may continue to increase in extent. This growth may continue for years, until the tumor is as large as the palm of the hand.

Before superficial cancer has reached large dimensions, the parts affected usually undergo secondary changes. As a rule, these develop spontaneously, inasmuch as the upper layers of epithelium undergo granular degeneration, a hyaline metamorphosis with subsequent necrobiosis in consequence of insufficient nutrition. Such a growth is usually shining, like mother of pearl, dry, and of diminished consistence. Finally, lamellar exfoliation occurs, and a small erosion results.

Another form of degeneration is due to the fact that, in consequence of the pruritus generally present in the beginning, the neoplasm is scratched or it is injured by instruments, etc.; the lesions due to the scratching, etc., then initiate the destructive degeneration. In the first event, the erosion is covered with a rather firmly adherent, whitish gray, or yellowish crust; in the latter event, with a brownish crust composed of dried blood. The removal of the crust shows a rounded excavation, with sharp borders; it may remain unchanged for months.

A carcinomatous ulcer situated in the corium is first of a round shape, later it becomes irregular. The base is pale red, shining, finely granular, hard, and secretes a scanty serous fluid containing very few cellular elements. The edges are irregular, steep, and present the pathognomonic hardness even if the imbedded nodules degenerate. These foci of degeneration do not occur singly or with any degree of regularity, but a cancerous surface contains a number of spots of loss of substance, some of which are isolated, some confluent.

Sometimes the cancerous mass imbedded in the corium at the site of ulceration is entirely destroyed by the degeneration, giving rise to a sort of spontaneous recovery. Normal granulations then form on the base of the loss of substance, and gradually a new epidermic cover is formed, or by the coalescence of grayish white islets of epidermis larger or smaller portions receive a new tegumentary covering. As this process is repeated quite frequently in superficial cancers of the skin, ulcerations and cicatrices are found alternating with one another.

If the spontaneous recovery by destruction of the morbid products continued uninterruptedly, there would be a chance that the recovery would extend not merely to a circumscribed spot. But unfortunately the cicatrization not alone takes place very slowly, but it often ceases to advance, is attacked by the proliferating cancer, and finally destroyed.

The cancer may pursue a still more unfavorable course, if it spreads more deeply in one or more places, and thus leads secondarily to the development of the deep-spreading

variety. Or cancerous nodules form at the outset in the deep layers of the corium, the subcutaneous connective tissue and the cutaneous glands. This condition is characterized by the presence of an extensive infiltration or one or more large nodules. In the beginning the affection is not readily recognized on account of its deep localization. But, as the disease spreads, it becomes more evident until finally the skin is thoroughly infiltrated and the neoplasm is palpable as a prominent, either rounded or flat tumor. The surface may be smooth, furrowed, nodular, or papillary, is of a waxy, pale rose to livid red color, traversed by vessels and shining in appearance. Whether in the form of an infiltration or nodules, the growth is very little or not at all movable upon its base and is strikingly hard. After the lapse of years, central or peripheral degeneration usually sets in. This process may develop spontaneously or be excited by injuries. If a crust forms over a slight erosion, the same conditions are observed as in superficial cancer, but annoying pains may be experienced and hemorrhages occur readily. But if the degeneration occurs *en masse*, it is preceded by a deep, dark red color, a doughy or elastic, fluctuating feel and increased temperature; this may be associated with moderate hemorrhage. The cancerous ulcer which results varies from the size of a pea to that of a walnut, is round or irregular in shape, has an irregular, nodular, dirty yellow, hard base, covered with necrotic shreds of tissue, and its edges are sharply defined. The surface of the ulcer secretes a moderate amount of sero-purulent matter, which soon dries and is removed with difficulty. Upon exercising lateral pressure, comedo-like plugs emerge from pin head openings or a yellowish white, fatty pap mixed with pus is discharged. In the most favorable event, ulcerations of this kind heal after extensive destruction of the cancer bodies; their complete and permanent cicatrization is an event of the rarest occurrence. As a rule, when the cancer is left to itself, it continues to proliferate towards the surface as well as into the deeper parts. In the former event, it projects like a mushroom to a variable height above the level of the surrounding parts, and appears as a lobulated, compact, pale red ulceration, which is covered with a viscid or purulent fluid, bleeds readily, and is cartilaginous in hardness. Its decomposing secretion, etc., give rise to irritative conditions, ulcerations, etc., in the surrounding tissues.

Or the cancerous material which is spreading inwards does not retain its nutrition, so that proliferation and degeneration keep equal pace, and the ulcer then has a crater-like shape, its base consisting of gangrenous tissue covered with pus and ichor. Here and there small granulating spots may be observed.

The descriptions just given refer to carcinoma simplex and its varieties. In addition there are other forms of cancer which require special consideration.

*Papillary cancer of the skin* (carcinoma papillare).—Thiersch has called attention to the differences between warty cancer, a cancer due to excrescence-like proliferation of the base of the ulcer, and the cancerous wart, *i. e.*, a wart in a condition of cancerous degeneration. But he arrives at the conclusion that, because the cancerous wart in its further course is as malignant as the papillary, cauliflower proliferation of the base of the ulceration, there is no reason for regarding the first stage as a separate disease. I believe, however, that differences may be observed both in structure and clinical relations.

From a glandular, papillary base or a wart which has existed for years, papillary cancer of the skin may attain dimensions as large as the palm of the hand and has a broad or pedunculated base. When it reaches its highest development, it presents various stages of ulceration, from the initial to the fully developed. At the outer parts projections like hypertrophic papillæ are observed, either singly or in groups. They are small, hemispherical or cylindrical, pale or bright red, finely granular or rough, and

situated on a reddened, moist, infiltrated base. Towards the centre of the tumor the papillary outgrowths become higher, broader, vascular, firmer; they are either single or branched, and either covered with a glistening layer of epidermis or with yellowish to dirty brown crusts. If these crusts are removed, the surface beneath is usually found eroded and fissured. If the papillæ are separated from one another, it is found that the majority of the supposed solitary ones have a common trunk, which is hard and has a broad base. This and other parts of the tumor contain a smeary, decomposed mass or a foul swelling, purulent secretion. Upon lateral pressure comedo-like plugs, mixed with blood, make their appearance. The closer we approach the site of ulceration, the greater the number of destroyed papillæ. At the ulcer the papillæ are irregularly fissured, covered with crusts, surrounded by ichor; between them are scattered several small ulcers or a single crater-shaped ulcer, the base and edges of which are similar to those of other cancerous ulcers.

Papillary cancer of the skin is observed most frequently upon the lower lip in males and upon the external genitalia of both sexes. They pursue a slow course, and are therefore less infectious and better suited for radical operations.

*Pigment cancer* (carcinoma melanodes).—This should be regarded as a special disease, on account of its occurrence in a "mother tissue" (pigmented spots in general), its rapid and unfavorable course, and its greater tendency to relapses. It varies in color from gray or grayish brown to black. The pigment is deposited either in the cells or the intercellular substance, but some cancer cells may present an entirely normal color. With each relapse the growth usually becomes more pigmented. The nodular shape and multiple development are comparatively frequent, but the superficial variety of pigment cancer may also be observed (eyelids, scrotum). It is the most infrequent of melanotic tumors and is therefore often mistaken for other varieties of pigment growths.

*Localization.*—The integument of the face is more frequently attacked by cancer than any other part of the general integument, constituting indeed nearly three-fourths of all such cases. In this situation it usually appears as a superficial induration or as a nodule. Often, also, it starts from a wart—a sebum wart of old people—and then presents a papillary appearance. In places which are abundantly supplied with sebaceous glands (tip and wing of the nose, chin, scalp, etc.), it often has an acne-like beginning and the yellowish brown crusts of sebum upon the nodules constitute the first symptom of the important process. In very exceptional cases the cancer appears in the beginning as a deep circumscribed nodule.

In the large majority of cases the further course of cancer of the face corresponds to its beginning, presenting the original superficial induration, the aggregated nodular or the papillary form, entirely independent of the size of the growth or the secondary changes (ulcerative destruction) which occur in places. But I do not mean to imply that severe and grave symptoms are more rarely observed, because the deep seated nodular form is so very infrequent in this locality. These cancers often proliferate and ulcerate very rapidly in the first few years (particularly papillary carcinoma) and we are never able to tell at what time the superficial ulceration will change into a deep-seated destructive process. Experience teaches, indeed, that cancers increase in malignancy in this locality as in others; their advance, however, is slower. They do not possess much infective power. When situated superficially, cancerous degeneration of the lymphatic glands scarcely ever occurs, and in hardly more than ten per cent of the cases which spread deeply.

The significance of cancer of the face and scalp lies mainly, therefore, in its tendency to spread superficially, and its consequent liability of affecting the periosteum and bones. It also possesses a tendency to spread along various canals and cavities to important organs. Thus, a cancer of the ridge of the nose has no very great significance so long as it remains superficial; but this changes when it spreads through the entire thickness of the tissues or makes its way into the nasal cavity from the edge of the wing of the nose. The cartilaginous and osseous portions of the nose and its septum are then destroyed, and by spreading externally over the upper lip and cheek and internally upon the nasal mucous membrane, the cancer may pass into the pharynx, and through the horizontal plates of the palatal bones into the mouth, etc. Similar devastation may result when the carcinoma develops on the cheek and spreads through the skin and muscular tissue. If the upper maxilla is infiltrated, it becomes necrotic and, according to the part affected, the teeth are lost, the antrum of Highmore is perforated, and the process may spread through the orbital fissure to the orbital cavity and even to the dura mater.

If the carcinoma extends to the eyelids, the eyeball is in continual danger even though the cancer is situated superficially. The upper and lower lids may be destroyed to such an extent that a plastic operation must be performed in order to relieve the resulting ectropium.

It is not very infrequent, also, to find the entire lid destroyed or the conjunctiva involved in the process, thus causing imminent danger to the globe. It should not be forgotten, however, that the process may stop at any stage of its development, and become extinct.

Cancer of the lower lip is not infrequent, but is much more common in men than in women. The beginning of the disease is manifested by a projecting infiltration or infiltrated nodule at or near the vermilion border; this receives manifold injuries on account of its location, leading to the developmet of fissures. Nevertheless one to three years elapse before ulceration occurs. Upon examination, the affected spot presents an elevated, sharply defined, hard little tumor, which may be mistaken for a syphilitic ulcer. The lower lip is freely movable, as is also the integument of the chin. As the neoplasm develops, it grows in all directions. It spreads to the mucous membrane, which becomes infiltrated and swollen, and also towards the chin, which becomes more resisting and rigid. Later the process spreads more deeply into the lip, which is then moved with difficulty; the gums are loosened and the teeth are not so firmly imbedded. The new growth then forms a flattened, hemispherical prominence, possesses either a finely granular or papillary, fissured surface, and, upon lateral pressure, discharges numerous convoluted plugs, composed chiefly of epithelium and fat, and also a fatty pulpy mass which, in addition to the above-mentioned constituents, contains pus cells. At a later period the cancerous degeneration may involve a considerable portion of the surrounding tissues, extending on the one side to the floor of the mouth, the tongue, pharynx and larynx, and on the other side to the alveolar process of the inferior maxilla, causing caries and necrosis. The submaxillary and cervical lymphatic glands are also implicated. In such cases metastatic nodules develop not alone upon the general integument, but also in internal organs. Death often is due to hemorrhage, but usually to marasmus.

Cancer of the external genitalia varies according to its situation. The superficial variety predominates upon the scrotum, in which it very often begins in the form of a traumatic or dyscrasic ulcerative process, chronic eczema, etc. Not infrequently it contains a considerable amount of pigment, forming carcinoma melanodes, but even then it

retains the tendency to spread superficially. Infected lymphatic glands or metastatic deposits are rarely observed during its course. Scrotal cancer may extend to the thighs, penis, and the lower part of the abdominal walls.

Superficial cancer is also observed quite often upon the outer layer of the prepuce, but by no means so often as upon the inner layer and upon the glans, on account of the numerous exciting causes (irritating secretions, uncleanliness, etc.) to which these parts are subjected. For this reason, also, cancer spreads more rapidly in this region. If it begins in a previously normal spot, the epithelial covering of the new growth is first raised like a vesicle or pustule, which bursts after the lapse of one or more weeks, leaving an erosion. The process usually does not receive any serious attention until the new growth and ulceration have extended more deeply as well as superficially. It is distinguished from syphilitic ulceration in the following manner: The cancerous ulcer, as a rule, is deep-seated, of very slow growth, has an irregular, discolored, extremely painful and very hard base, containing necrotic tissue, and bleeding readily on contact; the edges are steep and sclerosed. The surrounding tissues are strikingly hard, and extensive œdema may be present, the dorsal blood-vessels and lymphatics are converted into hard strands as thick as the finger, and the inguinal glands become hard and painful, their size varying from a hazelnut to the fist. Under increasing pains the glands break down, the ulcerations assume the carcinomatous character, and the vital forces are steadily sapped. The diagnosis of cancer becomes more difficult when the process begins in a condyloma acuminatum. For this may grow into a papillated tumor as large as a goose egg, may ulcerate in places and perforate the prepuce or corpora cavernosa (Foerster's destroying papilloma), while its appearance at the circumference may remove the suspicion of malignancy. In such cases the character of the ulcer must be very carefully observed. Whenever possible, little pieces should be removed from suspicious localities for purposes of microscopical examination.

Carcinoma of the labia majora begins either as a superficial nodule, or a trifling wart or a deep-seated infiltration; the further course of the disease varies in a corresponding manner. At times the process spreads over the surface, extending beyond the mons veneris, inguinal region, and introitus vaginæ. At other times it extends deeply, either in a circumscribed locality, or devastating the vagina, perineum, and rectum. Cancer of this region rarely assumes the papillomatous, cauliflower form.

The trunk is rarely the site of idiopathic cancer, the process usually spreading to it by contiguity from the back or neck, the external genitals, or the limbs. It presents no clinical or etiological peculiarities.

In the majority of cases cancer of the upper or lower limbs occurs in connection with surgical diseases, such as caries, necrosis, fistulous canals, ulcers, etc., or in parts which have cicatrized after the termination of such diseases. The deep spreading form is, therefore, observed more frequently, or the papillary variety if the previous inflammatory irritation has lasted a long time. The devastations caused by the growth are very extensive, and, to render matters worse, old and debilitated individuals are usually attacked.

Paget's disease of the nipple (carcinoma) occurs often after chronic eczema of the part. In 1874, Paget reported fifteen cases of this kind, and others have since been reported by Munro, C. Anderson, Sherwell, etc. If we study carefully the clinical histories of these cases, we will arrive at the conclusion that they present no features entitling them to a separate classification.

*Prognosis of Cancer of the Skin.*—The prognosis should always be made with great caution, although it is not as unfavorable as when the disease is situated in other local-

ities. Daily experience teaches that we are only able to limit its progress or extirpate it in the beginning of the disease. Nor can we expect very much from its spontaneous recovery, as permanent and complete results in this direction are extremely rare.

The serious prognostic significance of the cancer resides in the fact that any small remnant of the process, which had been regarded as extinct, may suffice to light it up again to the previous dimensions. So long as this takes place slowly and over a small extent, the patient suffers injury merely because the part implicated and the surrounding inflamed tissues lose their function. But as it progresses, the tendency to spread deeply develops, and the hope of radical recovery then diminishes more and more.

Cancers of the skin which are deep seated and extensive exert a deleterious influence in many ways. In the first place, important organs may degenerate, may be stenosed or atrophied by pressure, may ulcerate, etc. Furthermore, such cancers very often ulcerate and become gangrenous. In consequence of the continued suppuration, much material, which would be useful to the economy, is lost; the vessels upon the surface may be ulcerated and hemorrhages ensue which are checked with great difficulty; septic infectious particles enter the blood and the vital forces are destroyed by the disturbed sleep due to the constant pain, the loss of appetite, and the fever which develops at a later period. If the cancer is situated in a locality provided with numerous lymph spaces, lymphatics and venous plexuses, the adjacent lymphatic glands and then more remote organs become the seat of metastatic growths.

*Treatment.*—On account of the malignancy of cancer, the first indication is to remove the new growth as soon and as thoroughly as possible. At the present time the only measures recommended to effect this object are, 1. parenchymatous injections, 2. caustics, and 3. instruments of various kinds.

Injection of fluids was first practised by Simpson (1856), who injected a few drops of chloride of zinc, sulphate of zinc, etc., by means of hollow acupuncture needles. Luton made injections of sulphate of copper, tincture of iodine, alcohol, etc., and Broadbent employed 30 to 50 drops of a solution (1: 15) of acetic acid. The latter agent has since been discarded on account of the danger attending its use. Thiersch and then Nussbaum used injections of nitrate of silver (1 : 2000), followed by a solution of chloride of sodium. Of 15 cases treated in this manner by Nussbaum, the cancer disappeared in four cases after the development of suppuration and gangrene, in six the result was moderate, and slight in five cases. Heine also obtained good results from the injection of 0.1% of hydrochloric acid. On the whole, however, the method of parenchymatous injection has been employed too little to warrant a positive opinion concerning its value.

The effect of the different caustic remedies varies greatly. Some of them are quickly precipitated by the fluid in the tissues, and are thus effective on the surface alone; other are dissolved and destroy the tissues over a wide extent.

The solid caustics (fused nitrate of silver, caustic potash, sulphate of copper, chromic acid, the mitigated stick, etc.), are used in the form of a pencil, if we are justified in expecting that repeated applications will destroy the entire neoplasm. They may be applied to the surface in the form of a powder, when we wish to produce atrophy of the cancerous mass, improve the granulations, diminish the ichor, and relieve the foul odor. With this end in view, Esmarch has recently recommended the application of half a drachm of the following powder: acid. arsen. and morph. muriat. āā 0.25, calomel 2.0, and gumm. arab. 12.0.

Liquid caustics (fuming nitric acid, concentrated sulphuric acid, acetic and chloracetic acids, solutions of nitrate of silver, corrosive sublimate, etc.) are employed with

relative infrequency and in the superficial varieties, as they are liable to invade the healthy tissues.

As a paste, caustics are employed most commonly and in the following forms :

*a.* Vienna Paste, consisting of caustic potash and unslaked lime. It is prepared immediately before application, the caustic potash and unslaked lime, in the form of powder, being poured into a saucer and sufficient alcohol added so that, when thoroughly rubbed up, the mass has a soft pasty consistence. After the healthy integument in the vicinity of the carcinoma has been protected by adhesive plaster, the paste is applied with a wooden spatula and allowed to remain from 10 to 20 minutes. In order to remove the paste, the patient is either placed in a cold bath or the part washed with water. The pain produced by the caustic then subsides, and a dirty gray to dark brown, mortified mass of tissue is revealed. At the end of eight to ten days this is exfoliated and, if the carcinoma has been entirely destroyed, a granulating surface makes its appearance. If the effect has been insufficient, the procedure must be repeated

*b.* Chloride of zinc paste, consisting of liquor zinci chlorati with a sufficient amount of flour to give it a proper consistence. It is best to prepare it immediately before using it, the proportions varying according to the effect desired ; it is spread upon linen and then applied. The site of application should first be made sore or at least moistened with a solution of caustic potash, in order to produce a more vigorous effect. The paste is kept applied for four to twelve hours. After its removal, a dirty, greenish brown, dry scab is visible, which is cast off at the end of ten to fourteen days ; a granulating surface then makes its appearance. Chloride of zinc paste penetrates deeper than all others, but it also causes more pain.

*c.* Arsenic paste, consisting of pulvis cosmi (hydrarg. sulphurat. rub. 120, carbo animalis 8, resina draconis 12, acid. arsenios. 40) rubbed into a pulpy mass with some water. This is spread on linen and kept applied for three to five days, being renewed every twenty-four hours. The bluish red scab which is produced requires on the average two to three weeks for its exfoliation. This caustic produces severe reaction in surrounding parts, acts slowly and quite superficially, but it causes less pain than other caustics. On account of the danger of poisoning it is rarely used at the present time.

The use of the constant galvanic current, either in the form of the galvano-cautery, electrolysis or catalysis, constitutes a transition stage between treatment with caustics and purely surgical measures, though electricity is very rarely used in this disease.

In the extirpation of cancer, the surgeon resorts to the knife and scissors. Th dermatologist will often dispense with these instruments, even when he proposes to extirpate the tumor. The Bruno-Volkmann sharp spoon is such a useful instrument that cutting instruments are only necessary when the tumors are pedunculated or involve the largest part of the circumference of a limb. To operate successfully with this instrument, the neoplasm must be scraped as thoroughly as possible, and the remaining parts will be exfoliated at a later period by the necrosis and suppuration resulting from the mechanical traumatism.

In a few words we will now give a rapid sketch of the measures to be selected in the treatment of cancer of the skin. When scattered, moderately large and superficial nodules or infiltrations are present, a solid caustic, particularly nitrate of silver, will be most serviceable. A single vigorous application often destroys the entire morbid process and the wound left over after the exfoliation of the scab may heal permanently within a few weeks. If the cancer spreads superficially, the fluid caustics and the sharp spoon are indicated. In anxious patients, who are afraid of loss of blood, fluid caustics should

also be employed. I make use of the following procedure: a pellet of charpie dipped in hydrochloric acid is rubbed upon the affected surface until it causes a superficial wound, and immediately afterwards cauterization is performed with another pellet dipped in a solution of nitrate of silver. The pain produced is not considerable and if the fluid penetrates into healthy tissue, it gives rise to very insignificant injury. The use of caustic pastes is reserved for the deep-spreading or rapidly proliferating forms of cutaneous cancer. Without entering into a comparison of the results following surgical operation and the use of caustic pastes, it may be stated with positiveness that the number of cases which should be treated by the latter means it is at least as great as the former. The use of caustic pastes is also indicated strongly in anæmic, cachectic, and old individuals, on account of the trifling loss of blood occasioned thereby.

In neglected cases, which cannot be operated upon, in old individuals, and the like, palliative treatment alone remains. Ulcerations should be kept thoroughly clean and dressed with finely powdered charcoal, chloride of lime, hypermanganate of potash, etc. When a larger blood-vessel is eroded or a considerable parenchymatous hemorrhage takes place, compression may be employed either with dry lint or pieces dipped in chloride of iron. The most important indication for such cases is the relief of pain; this is done by the administration of opium or morphine, either subcutaneously, internally, or applied to the ulceration.

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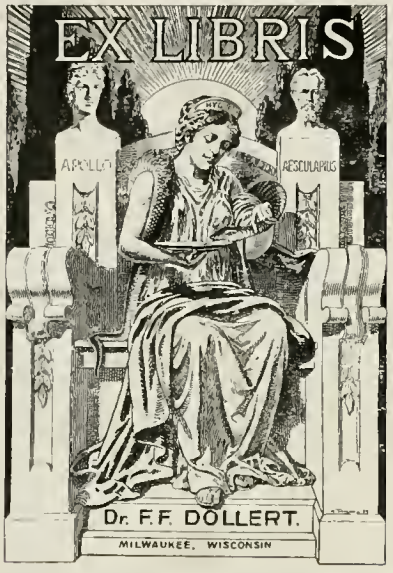
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