

For

Thomas Cook M.D. Sc.

with the respects of his
friend & former pupil

J. W. Sterling

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A
TREATISE
ON
SURGICAL ANATOMY;

OR THE
ANATOMY OF REGIONS,
CONSIDERED IN ITS RELATIONS WITH SURGERY.

ILLUSTRATED BY PLATES,
REPRESENTING
THE PRINCIPAL REGIONS OF THE BODY.

BY
ALF. A. L. M. VELPEAU, M. D. P.
Agrégé Stagiaire to the Faculty of Medicine of Paris, etc.

IN TWO VOLUMES.

TRANSLATED FROM THE FRENCH, WITH ADDITIONAL NOTES, BY
JOHN W. STERLING, M. D.
Member of the Royal College of Surgeons in London; Fellow of the College of
Physicians and Surgeons of the University of New-York, etc.

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Southern District of New-York, ss.

BE IT REMEMBERED, That on the ninth day of February, in the fifty-fourth year of the Independence of the United States of America, John W. Sterling, of the said District, has deposited in this office the title of a book, the right whereof he claims as proprietor, in the words following, to wit :

“A Treatise on Surgical Anatomy; or the Anatomy of Regions, considered in its relations with Surgery. Illustrated by Plates, representing the different Regions of the Body. By M. A. L. M. Velpeau, M. D. P. Agrégé Stagiaire to the Faculty of Medicine of Paris, etc. In two volumes. Translated from the French by John W. Sterling, M. D., Member of the Royal College of Surgeons in London; Fellow of the College of Physicians and Surgeons of the University of New-York, etc.”

In conformity of the Act of the Congress of the United States, entitled, “An Act for the encouragement of learning, by securing the copies of Maps, Charts, and Books, to the Authors and Proprietors of such copies, during the time therein mentioned;” and also to an Act, entitled, “An Act, supplementary to an Act, entitled, an Act for the encouragement of learning, by securing the copies of Maps, Charts, and Books, to the Authors and Proprietors of such copies, during the times therein mentioned, and extending the benefits thereof to the arts of designing, engraving, and etching historical and other prints.”

FRED. J. BETTS,

Clerk of the Southern District of New-York.

TO

ALEXANDER H. STEVENS, M.D.

Professor of Surgery in the University of New-York ; Surgeon to the New-York
Hospital ; Consulting Physician of the New-York City Dispensary ;

Member of the New-York Literary and Philosophical
Society ; of the Academy of Natural Sciences
of Philadelphia ; of the Linnean
Society of New-England,
&c. &c. &c.

WHO, to Talents of the highest order, great Scientific At-
tainments, and Professional Skill, unites an Indefatigable Zeal for
the promotion of Medical Literature ; and to whose Encouragement
may be attributed this Humble Attempt to introduce to the general
notice of our countrymen, the Unrivalled Treatise of M. VELPEAU
on SURGICAL ANATOMY, is this Work inscribed

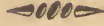
By his Greatly Obliged,

And Obed't Serv't,

JOHN W. STERLING.

New-York, Feb. 9, 1830.

P R E F A C E .



IF it is true that indolence, a false judgment, ignorance, self-love, or any other mistaken notions, have induced certain persons to say that one may be a skilful and learned physician without being a good anatomist, we may affirm that this paradox will no longer be revived at the present day: now that it is the universal desire to substitute facts for chimerical abstractions; now that the remains of the dead constitute the principal book in which physicians seek for the cause of diseases, it is no longer necessary to insist upon the indispensable necessity of anatomical knowledge; but there is one branch of medicine to which this knowledge appertains in a still more intimate manner, and with this opinion learned men have always coincided,—I mean Surgery.

Anatomy, which is only a collection of facts, though it had been cultivated by some few during a long succession of ages, was restrained within very narrow limits, until the progress of civilization, by banishing existing prejudices, shed upon it the light derived from other branches of natural philosophy. When dissections were permitted, discoveries multiplied with rapidity, and its details became formed into a system. The more recent labours of anatomists have so far enlarged the domain of their science, that subdivisions of it have become necessary both for the study and the improvement of it.

To examine the organic systems and whatever they possess in common in every part of the body, is the object of general anatomy; to study the apparatuses in succession; to describe the figure, volume, position, density and composition of each organ is the province of descriptive or special anatomy; to take a certain portion of the economy, describe all the elements which are comprised within it, and point out the peculiarities which each of them present; the direction and exact relations of the most important objects; the varieties of thickness and position produced by diseases or aberrations of development; to proceed from the skin towards the bones, or from the bones towards the surface, and thus observe successively, and layer by

layer, in their relative and natural position, the different parts, without entering into minute details; this is what constitutes the anatomy of regions or of relations, or topographical anatomy.

The first, more particularly concerned with the fibrillary arrangement, and the analysis of the intimate structure of the tissues, is the basis of all sound physiology; without it, medicine would never have emerged from that confusion of principles which so long prevailed in the schools: it truly deserves the title of medical anatomy.

The second, displaying the organs in the manner which nature presents them, describing their most prominent characters, without investigating their molecular disposition, or those unknown vital properties from which they derive life and motion, appertains, more directly to surgery, which owes to it its rapid progress and the certainty with which it is honoured: without it, the surgeon would be but a dangerous man.

The third is as yet altogether new, and can only be considered as a complement of the two others. It differs from common descriptive anatomy, both by the end which it proposes and the means it employs. This takes up one apparatus of organs and follows it to every part to which it is distributed, previous to taking up the consideration of the others; that, on the contrary, passes in review all the elements of a circumscribed point, without investigating either their origin or termination. The one tends to make known the special functions of the economy; the other to expose the different characters of this or that part of the body; to give the mechanical reason for the diverse phenomena which we remark in it; to explain the difference in the dangers and forms of diseases, by the difference in the relative and visible disposition of the systems which compose this or that region; it dwells upon some organs, passes lightly over others, always seeks to place itself in relation with operations; in a word, it is the anatomy which is most intimately connected with external pathology, and which, for this reason, is called *Surgical*.

Some positive notions upon surgical anatomy and the anatomy of regions, were first promulgated by Desault, in his oral lectures; and all who enjoyed the benefit of hearing this celebrated surgeon, agree in saying that he felt its great importance; but baron Boyer is the first author who has written upon this subject, and his immortal work on anatomy contains a sketch of an anatomy of regions which must dispose us to regret that he did not enter more fully into this matter. I say the first, for the *Treatise on Surgical Anatomy* by Palfin, published in the beginning of the last century, is a very indifferent work, decorated with

a vain title. That of Petit was composed after the same model, and deserves, in a great measure, the same censure; neither of these authors had, in fact, investigated this subject under its proper aspect.

Professor Roux next attempted to incorporate it with his course of lectures, and he undoubtedly deserves the honour of directing the attention of the students of the school of Paris to this particular branch of anatomy. Several theses, written after the model of his lectures, shew that M. Roux then considered, and, from what I have heard him express, still considers surgical anatomy under two different points of view. On the one hand, he would that all the organic apparatuses were examined in succession, according to their relations with surgery: thus, the skin, cellular tissue, muscles, etc., should be successively studied in this manner, and the theses of M. Baget upon the cellular tissue, of Bajcard upon the muscular tissue, were arranged according to this method; this is what M. Roux proposed calling general surgical anatomy. On the other hand, he thought that we should investigate all the organs in their relative situations, which would constitute the anatomy of regions, properly so called. But he who undertook to continue the *descriptive anatomy* of the most brilliant genius of our age, was shortly after called upon to attend to other duties, and the impulse, which had been given with so much advantage to anatomical students, sensibly diminished. Its utility, however, was not forgotten. Already had it attracted the attention of Bécclard, who entered upon its investigation with so much assiduity, that he soon transformed the projects of M. Roux into reality. To the natural divisions of the body, he added secondary divisions; he circumscribed the principal regions, and the sketch which he made of topographical anatomy, in his course to the Faculty of Paris, presented itself under an aspect so imposing to the numerous students who were eager to hear him, that it thenceforth became the favourite study of the greater proportion of them. Indeed, it is sufficient to turn to the articles *Axilla, Arm, Elbow, Fore-arm, Ham, etc.*, which he has contributed to the *Nouveau Dictionnaire de Médecine*, in order to have an idea of the interesting remarks which accompanied his descriptions. It is from him, from his instructive lessons, as well as those of an equally revered professor, M. Marjolin, that young surgeons imbibed a taste for this subject; but students wanted a guide, an elementary work to direct them; Bécclard had promised to furnish it; it was eagerly anticipated, and every thing favoured the belief that it would soon have been presented to the public, if a premature death had not deprived anatomy of one of its brightest ornaments and firmest supports. This professor has left, in this respect,

as well as in many others, a chasm which it is very difficult to fill up, and which is so much the more severely felt in the science, as we begin generally to admit, at the present day, that the anatomy of the regions is less dry, and that it is of still more immediate application in surgery than descriptive anatomy, such as it is exposed in our best treatises. It is with the view of closing this hiatus that I have undertaken to present to the public an Essay on Surgical Anatomy, and the Anatomy of Regions. I do not presume sufficiently upon my own abilities to suppose that I have fully accomplished my object: I merely thought that it would be agreeable, to students especially, to possess some book upon this subject, whilst waiting for some more capable person to engage in it, or until I could produce a better myself. However, I have neglected nothing that might render this work useful to the greater number, and I must say that I did not undertake it until I had long reflected upon it. It is to M. J. Cloquet, one of my first preceptors in Paris, that I am indebted for the first idea of it; we began together at the Hospital Saint Louis, in 1821; the regions were already traced, when the attention of this learned anatomist was called to other labours. Nevertheless, I did not abandon this project, and in 1822, I submitted our plan to some students, to whom I gave a course upon this subject in the amphitheatre of the *Ecole-Pratique*. Since then I have not ceased occupying myself with it, and I have closed my anatomical demonstrations every year with some lectures upon surgical and topographical anatomy: thus, by teaching, I have been enabled to make trial of several different methods. That which I have at length adopted, is not altogether the same with the plan which I pursued at first; neither is it analogous to that of Professor Bécлар. Having no model to copy after, I was obliged to depend upon my own judgment; I sought, however, to enlighten myself by every possible means previous to deciding. For the divisions I consulted the manual of Rosenthal, professor at Berlin,* but the only one I am acquainted with, in which all the regions of the body are described; an essay of Doctor Bock,† printed at Leipsic, in 1824, accompanied with three figures, in which arbitrary lines, serving to limit a certain number of sections, are traced; the thesis of M. Gerdy, my colleague to the Faculty, published in 1823,‡ and in which we find a topographical sketch of the different parts of the body of man considered in nearly the same point of view as in the work of M. Boyer. It will be easy to see how far I differ in this respect, from these authors, and in what degree I approximate to

* *Handbuch der chirurgischen Anatomie*. Berlin, 1817. † *Der menschliche Körper*, etc. von Dr. August Carl Bock. ‡ No. 143, page 29.

them. For several years also, my friends, MM. Bouvier, associate, Blandin, Bogros, prosectors, and Amussat, anatomical assistant to the faculty, have been engaged in teaching the anatomy of regions with much success, but as they have not published the plan which they follow, I have not been able to profit by their knowledge, nor ascertain in what measure their method differs from mine.

With respect to the fundamental part, I have drawn from all the sources which I have been able to discover; and I mention them here, in order that I may avoid too frequent citations in the text, and also that every person may there resume whatsoever appertains to him. I have especially had recourse to such works as treat particularly of a given point of the body; and I will mention, among others, for the Eye, the works of Zinn, Sæmmering, Demours; some numbers of the *Bibliothèque Chirurgicale* of Langenbeck, the book published at Berlin in 1822 by Weller; for the lachrymal passages, a very good thesis of M. Vesigné, that of M. Dubois, Jun.; for the anatomy of the Neck and Head, the treatise of Allan Burns, one of the best works, on this subject, which have appeared in England, although it does not merit all the praise which it has received in the country of its author. In fact, it is not a treatise on surgical anatomy, nor of the regions of the head and neck; it would be better intituled—*Chirurgical Observations, accompanied with anatomical remarks*;—that of Doctor Colles, published in 1811, and which also treats of the surgical anatomy of the thorax, abdomen and pelvis; it enters less into detail than that of Burns, but is more purely anatomical; a very fine engraving of the neck by Astley Cooper, in one of the German journals for 1825;* other plates of M. Langenbeck, representing the parotideal region and divers other points of the head and neck; the fourth table of Santorini, one of Sæmmering upon the nasal fossæ, mouth and pharynx; the works of J. Fabrice and Duverney upon the Ear; of MM. Deschamps and H. Cloquet, upon the nostrils, etc.; for the axilla the theses of M. Mey (1817, No. 63); and of M. Beulac (1819, No. 220) arranged according to the lectures of M. Roux; that of M. Senelle (1822, No. 143) upon the thoracic extremity; for the shoulder, the fingers, foot thigh, perinæum of the female, the canal of the urethra, etc. several memoirs of M. Lisfranc; for the different parts of the pelvis, perinæum, groin, the researches of Camper, and the plates executed in part under the inspection of this celebrated author; the splendid work of W. Hunter upon the pelvis and gravid uterus; that of Hesselbach, who has so correctly described the disposition of

* *Chirurgische Kupfortafeln.*

the aponeuroses of the fold of the groin, and the relations of the epigastric artery in hernia, in 1806, 1816, and 1819; those of M. J. Cloquet, Astley Cooper, Hey, Lawrence, upon the same subject and hernia in general; the thesis of M. Breschet, on crural hernia; the researches of Langenbeck, in 1802, and of M. Dupuytren, in 1812, upon lithotomy and the perinæum; of MM. Carcassonne and Bouvier, upon the aponeuroses of the pelvis; Bogros, upon the iliac region; Sanson and Scarpa, upon the recto-vesical lithotomy; several memoirs of the latter, and his elegant plates upon aneurisms, herniæ and hydrocele; the first part of the system of surgical anatomy by Dr. W. Anderson, upon the groin, pelvis and perinæum, published at New-York, in 1822; the essay which Dr. Ashton Rey has just published in London, upon the section of the prostate in lithotomy, according to the process of Cheselden, and his plates upon the pelvis; finally, the thesis of M. Senn, of Geneva, upon the perinæum and the different forms of perinæal lithotomy. I ought also to note three drawings which are found in the memoir of Dr. Liston, published in London, in 1811, upon the fold of the groin; the work of Græfe upon amputations, printed at Berlin, in 1812; (on this subject, I would remark, that I have passed by the name of this celebrated surgeon in silence, when speaking of the staphyloraphy, not because I was ignorant of his having performed this operation in 1816, and a considerable number of times since; but because the method of M. Roux, which actually seems to have originated with him in France, deserves the preference in every respect); the *system of surgical operations*, began by Charles Bell in 1821; the *Manual of Anatomy* by Stanley, and which is in fact an abridgement of the anatomy of regions; that of Green; and even that of Shaw; the *Anatomical System* of Lizars, just published in London; lastly, I would cite a treatise upon the aponeuroses by Dr. Godman of Philadelphia, and another meritorious work upon the surgical anatomy of the arteries, by Robert Harrison of Dublin, both of which appeared in 1824-5.

With respect to classic treatises, I have principally derived assistance from those of Bichat, MM. Boyer, Portal, H. Cloquet, and J. Cloquet, for the anatomy; the manual of the celebrated F. Meckel, has also been of much service to me, especially as it regards the varieties and anomalies of position. For the surgical part I have made use of the excellent book of Sabatier, as well as the additions of its new editors. I might cite at every page the treatise on Surgical Diseases by M. Boyer, and the Nosographie of M. Richerand, I have especially borrowed from the latter professor a part of the lines which he first in-

icated for the purpose of discovering the direction of the principal arteries of the extremities. In a word, I have endeavoured to profit by the numerous works which have been published, during a century, upon anatomy and surgery, in France as well as in England, Germany, Italy, etc.; and, as regards this, I take this opportunity of presenting my acknowledgements to Dr. Crawford of London, for the zeal and activity which he has manifested in procuring for me the works which I had need of, and to M. Wessley, doctor in medicine of the University of Gottingen for the assistance he has afforded in enabling me to understand the numerous publications in the German language. Also to M. Paillard, internal surgeon to the civil hospitals, my friend and former condisciple at the Hospital St. Louis, who, having been for a long time prosecutor to M. Lisfranc, and engaged for several years in surgical anatomy, has collected an abundance of materials, both on the subject of general surgical anatomy and the anatomy of regions, which cannot fail being useful to the science, if he publishes them, as he has promised. By placing his manuscripts at my disposal, he has given me a proof of confidence which does honour to his character, and which it is my duty thus publicly to acknowledge.

A combination of circumstances so favourable imposes upon me, I am well aware, great obligations. My province has been rather to make a selection among a multitude of facts than to search too minutely after new ones. Nevertheless as the subject was not before surveyed from the same point of view, and as the objects of it were appreciable; as the most scrupulous exactness in the relative position of the parts is the chief merit and distinguishing character of a Treatise on Surgical Anatomy, I have considered it my duty to derive this from Nature alone. Therefore, all the regions have been circumscribed upon the dead body, and I have not indicated a part, described a layer, or given a measurement without having a subject before me. It was not until I had repeatedly examined the different elements of a region that I had recourse to authors or ventured committing them to paper; then if my descriptions coincided with those of the most accurate anatomist, I considered them correct; but if, on the contrary, they differed, I again returned to interrogate the dead body and forbore to contradict until I had established the certainty that some circumstance had deceived them. In this manner, I have only dwelt upon the description of parts in proportion to their degree of importance, and with some I have entered more into detail than is usually done in elementary treatises: such, as for example, the cellular tissue, the different aponeuroses, and the layers which are derived from

them. It is, in fact, only in investigating anatomy by regions that we can conveniently dwell upon the disposition of these laminæ, which actually deserve additional investigation; on the other hand, I have thought proper to omit many indifferent minutiae which relate to surgery, although they might afford great interest in a treatise on descriptive anatomy.

With respect to the numerous preparations required, and all that portion of this labour which it was necessary to perform in the dissecting room, I have derived assistance from several persons, and I cannot, on this occasion, give too much credit to my prosector M. Bintot, for the accuracy which he has exhibited. To M. Ch. Delange, an enterprising student of the Faculty of Medicine of Paris, more than any other, I owe a testimonial of gratitude for the entire devotion which he has shewn me in this respect, and for the active part which he has not ceased to take in every thing that concerns this work.

Detained a long time by the first step, that is to say, by the division which it would be most proper to establish, and by the number of regions which might be usefully admitted, I was apprehensive of falling into two opposite extremes: too multiplied, they would fatigue the memory and occasion incessant repetitions; too few, they would not enable us to display advantageously every important part contained within them. The great natural sections of the body being insufficient, I have substituted for them arbitrary lines, which I have connected, as much as was possible, with osseous or muscular eminences. These lines seem to me to present the inappreciable advantage of embracing in a given region, objects which can only afford surgical interest so long as we consider them united and in their natural connexions: thus, should we separate the arm from the fore-arm, the elbow would remain without importance; the considerations relative to blood-letting, to the formation of aneurism in this region, would no longer be applicable; if the arm ceased to be connected with the shoulder, the axilla would no longer exist; finally, it is in the environs of the principal folds of the limbs that the most severe and important surgical operations are performed. But these lines might have been established in diverse manners; they might have been more or less approximated or different directions given them, etc. Every one doubtless will have his particular opinion on this subject. Those which I have traced seem to me to fulfil tolerably well the principal indications; however, I attach very little importance to them, and if it can be demonstrated to me that I might have chosen others of more general utility, I will be the first to modify them.

The order of arranging the descriptions caused still greater embarrassment, because it is more connected with the most prominent part of the subject. At first, I found it more natural, more physiological to begin the examination of a region with its skeleton, and terminate it with the cutaneous envelope: but this book being particularly destined for those who study or operate upon the dead body, I thought that it would be more convenient for them if the inverse method was adopted. The first is altogether synthetical, and can only be of use to those who have already acquired the knowledge, or who labour in the silence of the closet. The second, on the contrary, truly analytical, seems to me perfectly to fulfil the end of the student and operator, displaying the different organs in the order in which they present themselves under the knife, it admits of their being studied better, and it is more surgical and more anatomical.

As it regards the fundamental plan and the nature of the work, I have selected from several methods which naturally presented themselves to my mind. I might have restricted myself to enumerate in each region, and layer by layer, without distinction of tissue or of organs, the parts which compose it; but then it would have been difficult to give a distinct perception of their precise relations. By taking successively each system in particular, it has not always been possible for me to follow exactly the order of superposition of the organic planes; but I found that it was the easiest method of pointing out the principal peculiarities and positive relations of each organ with those which surround it. It appeared to me also that, by this method, the descriptions would be less burthensome to the memory and better understood: however, although the anatomy would have been a little less dry and uninteresting, presented under this point of view than under the preceding, it would not have attained its principal object of utility; it would not have been surgical. Finally, I might, in the first place, have described each system, and afterwards the surgical remarks which appertain to it, after the manner of several English surgeons, and especially MM. Anderson of New-York, and Harrison of Dublin, as well as of MM. Lawrence, Scarpa, Boyer, etc., in treating of herniæ; but then this would have been a treatise on descriptive anatomy on the one part, and on surgery on the other. As all these modes of investigation conduct more or less directly towards the end which I proposed myself, and in another sense deviate from it, I have attempted to amalgamate them, lopping off whatever was superfluous or foreign to my subject, endeavouring to combine surgical anatomy with that of the regions, and surgical anatomy by system of organs, with topographical

anatomy and the anatomy of relations, without establishing any distinction between them.

To recapitulate :—I have had no intention of making a treatise on anatomy to supply the place of those which we already possess, nor a book of surgery nor of operations, but to collect in each point of the body of man the knowledge which naturally flows from the parts which we there meet with : to propose an anatomy, by the aid of which the surgeon may always foresee, previous to practising any operation whatsoever, all the accidents which may immediately follow it, and all the precautions which it requires relatively to the parts which should be preserved or avoided ; by the aid of which, one point of the body being given, it will be possible to tell, within a few lines, what are the fibrillæ, arteries, veins, nerves, muscles, etc., which must lie in the way of the instrument ; and it was with the view of accomplishing this end still more effectually, that I was disposed to describe from the central point to the periphery, upon sections made at different heights of the trunk and extremities, all the objects which present themselves to the eye. I was also inclined to traverse the body in a great number of directions and at different points, with metallic rods, in order to indicate, by leaving them in place, the nature and situation of the organs thus trans-fixed ; but I was apprehensive of making the work too voluminous, and therefore have reserved this project until a future opportunity.

It is especially in the anatomy of relations that designs well executed would be of great assistance ; for by a simple glance at a region correctly represented, the mind seizes, embraces much better what is required to be acquainted with than by means of a lengthy description ; and in default of dead bodies, I know of nothing that can be substituted for plates. Those which accompany this treatise have been drawn from nature by M. Chazal, one of our most distinguished artists, the person who is employed in executing the elegant designs for M. Maygrier's work upon accouchemens. I was at first disposed to profit by his skilful pencil, in order to represent a much greater number of regions under different aspects, but I soon perceived that this would increase the price of the work far beyond what would be convenient for the greater number of the readers to whom I address it.

Finally, in order that this work might be what it ought to be, still more numerous researches, and a greater length of time than I have been able to devote to it, are necessary. I am well aware that it has many defects, and criticism will unveil others which I am not conscious of. I have hastened to publish it for the winter, in order that students might make use of it during the session which is about to

open ; with the view also of exciting others to works of this kind, and of attracting the attention of surgeons and anatomists to a subject which must be productive of great practical benefit. I have done every thing in my power to render it useful and to avoid advancing what was not correct ; if, however, blemishes too numerous should be discovered in it, my only apology is a sincere desire to remove them hereafter, and my grateful acknowledgements to those who will kindly point them out to me. I must also claim some indulgence ; requesting it to be kept in remembrance that it became necessary for me to trace the way, and that "*on ne fait point de l'anatomie par la seule force de la pensée.*"

PARIS, November 1st, 1825.

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ERRATA.

- Page 3, line 8, for "at its central," read "in its middle."
- " 7, " 24, for "aponeurosis," read "aponeuroses."
- " 29, " 8, for "membrani," read "membrana."
- " 37, " 4, for "the slide," read "slide."
- " 45, last line, for "eye-lids," read eye-lashes."
- " 80, line 23, for "a deep branch," read "and a deep branch."
- " 136, " 4, for "cornea," read cornua."
- " 202, " 15, for "porrigo," read "prurigo."
- " 225, " 4, for "The *Subscapularis*. The anterior," read "The *Subscapularis*, the anterior."
- " 277, lines 6 & 7, for "and where it dips, the deep-seated sheet, is also applied to it, down into the external furrow," read "and it is also applied to the deep sheet, where it dips down into the external furrow."
- " 277, line 38, for "fibrous sheet sheath," read "fibrous sheet (*sheath*)."
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SURGICAL ANATOMY.



CHAPTER I.

OF THE HEAD.

THE head is composed of the cranium and face.

ART. I. OF THE CRANIUM.

This part of the head may be divided into three regions on each side of the median line. These regions will be circumscribed by arbitrary lines, drawn from natural prominences, and designated by the name of the principal bone corresponding to them; as, for example, the frontal, temporo-parietal and occipital regions.

Sect. 1. The Frontal Region.

It is triangular, and bounded, inferiorly, by a curved line extending above the eyebrow from one of the orbital processes of the os frontis to the other; internally, by the median line which separates it from its fellow on the opposite side; and externally, by a third line which ascends from the external orbital process,

in the course of the fronto-parietal suture, to the origin of the sagittal suture.

The surface of this region presents, inferiorly, a transverse furrow of greater or less breadth ; in the middle, a more or less prominent bump, constituting the frontal groove and protuberance ; internally, the frontal vein and some one of its branches ; and superiorly, the hair, which descends more or less in different individuals.

COMPONENT PARTS.

I. *The Skin.*

This is thin and smooth in children and young persons of both sexes ; in adults, and old people especially, we sometimes observe numerous transverse wrinkles in the lower half of this region. Upwards and outwards, where it usually serves for the implantation of the hairs, it is thicker and destitute of wrinkles. In this last direction it contains many sebaceous follicles. The hairs generally pierce the skin obliquely forwards or outwards, whence their tendency to follow one or the other of these directions in descending upon the forehead.

II. *The Cellulo-adipose Layer.*

Situated between the frontal muscle and skin it is generally very thin ; the cellular tissue which composes it is dense and compact ; the adipose cells are very minute and in close contact ; externally, near the temple, they are larger, less intimately connected, and sometimes form a layer of considerable thickness. The intimate union of this layer with the two strata between which it is interposed, explains the reason why lesions of the skin here are more liable to produce inflammations of the erysipelatus character ; for we may readily conceive that it would be difficult for pus to collect in the form of abscess in a tissue so compact. For the same reason also, when purulent or sanguineous tumours form in this region, they are always circumscribed, globular, or more or less flattened ; finally, it is in

this stratum that encysted tumours (*lupia*) or *tannes*,* which are merely the follicles enormously dilated and filled with a concrete sebaceous matter are developed: the roots of the hairs are likewise situated in it.

III. *The Muscles and Aponeurosis.*

The muscles are, inferiorly, a very small portion of the orbicularis palpebrarum; above this, the frontalis, which is thickest at its central, and especially its inferior part, where it covers the whole breadth of the bone; its fibres are parallel, and, on contracting, wrinkle the forehead. It seems as if these muscles were developed upon the external surface of the epicranial aponeurosis, which is thin and cellular beneath them; superiorly and posteriorly, this aponeurosis alone exists, and is there much stronger and decidedly fibrous. It is difficult to separate these parts from the subcutaneous stratum: to the pericranium, on the contrary, they are but loosely connected by a lamellated tissue, especially at the outer and inferior part of the region. This cellular tissue encloses a great number of adipose vesicles, in consequence of which disposition it happens that, when pus or other fluids are secreted into the space between these two layers, they become extensively diffused instead of forming distinct tumours. It is necessary to be aware of this circumstance, in order to determine the nature and danger of diseases situated in the frontal region.

IV. *The Pericranium.*

It presents nothing of importance; we have just noticed its relations with the musculo-aponeurotic layer; it is connected to the bones by a lamellated rather than a filamentous cellular tissue, so that it can be easily separated from the cranium, except at the sutures.

V. *The Arteries.*

These are branches of the supra-orbital, the trunk of which

* Acne.

was at first situated between the orbicularis and frontalis muscles; they afterwards creep in the subcutaneous layer. The anterior branch of the superficial temporal also runs through it, and forms numerous anastomoses with the preceding. The tissue which envelopes these vessels is so compact, that it is difficult to seize them with an instrument in order to tie them, therefore compression is generally preferred to the ligature. If, however, in consequence of acute pain or inflammation, we can only employ the latter, we will succeed better with a tenaculum than the forceps.

In the pericranium we only find capillary twigs of the deep-seated temporals.

VI. *The Veins.*

Near the median line we generally find the frontal vein, which is sometimes wanting, and, at other times, as we have seen it in two subjects, double or triple; it is often very large, especially in old people. The ancients frequently drew blood from it in affections of the head, and we think that this bleeding is at present too much neglected. This vein, in fact, returns the blood from the anterior half of the cranium to the root of the nose; therefore, it is evident, that by opening it we would immediately disgorge the vessels of the hairy scalp. This vessel is situated between the skin and the cellulo-adipose layer, and is not accompanied by any artery; consequently we may easily open it without danger of wounding any important organ. The other veins accompany the arterial branches and present nothing remarkable, unless it is that some of them pass through the frontal and fronto-parietal sutures to the longitudinal sinus or dura mater. These branches are generally small and destitute of valves: hence they might serve for abstracting blood from the interior of the cranium, if cupping-glasses, or leeches, were applied over the points of skin corresponding to them: it is for this reason that Santorini calls them *emissary veins*.

VII. *The Lymphatic Vessels.*

They are few in number, and but imperfectly known. They

pass into the glands of the parotideal region, and it is for this reason that diseases of the frontal region sometimes occasion tumefaction of the lymphatic glands in the vicinity of the ear; whether arising from the transmission of irritating fluids absorbed at the diseased part, or continuous sympathy, &c.

VIII. *The Nerves.*

They are derived from the fifth pair. As the internal frontal comes out from the orbit it is at first situated between the pericranium and corrugator supercillii muscle; it afterwards perforates the epicranial aponeurosis, in order to ramify in the fibres of the frontalis, and, more especially, in the internal half of this muscle. The filaments of the superciliary or external frontal nerve, on the contrary, are distributed to the aponeurosis and even to the pericranium, which gives them a flattened form and much firmness.

These nerves are spread out, for the most part, in the external part of the region, and anastomose, near the external orbital process, with some filaments of the facial; more posteriorly, they unite with the superficial temporal given off by the auricular branch of the inferior maxillary.

The nerves of the ganglionic system are blended with the arterial tunics, and are of no importance in surgery.

IX. *The Skeleton.**

It comprises only one of the halves of the os frontis. This bone presents: externally, the external orbital process, which, on account of its prominence, is very much exposed to fracture: from it commences the semi-circular line of the temporal fossa. At this point we sometimes find a veinous canal: from which circumstance, a perforation of the cranium here might occasion

* The term *squelette* (skeleton) is made use of by Mr. Velpeau to signify the frame work of each particular region, and therefore comprises, in several regions, not only the bones, but also the periosteum, ligaments, cartilages, &c. As no other word equally comprehensive and appropriate could have been substituted for it, it has been retained in the translation, notwithstanding English and American anatomists limit its application to the frame work of the whole system.—*Transl.*

a considerable discharge of blood without any injury of the vessels of the dura mater. Internally, we observe the nasal protuberance, which is more prominent in man, and in old age, than in women and children; also, in the latter the forehead is almost flat, and, generally, the root of the nose appears less depressed. This protuberance corresponds, anteriorly, to the head of the eyebrow; posteriorly, it forms the anterior wall of the frontal sinus, cavities produced by the separation of the tables of the bone, and with which it is of importance to be well acquainted; for the outer table alone may be fractured, and be mistaken for a depression of the cranial arch. As these sinuses are lined by a prolongation of the internal membrane of the nostrils, puriform mucus, &c., may be discharged from the nasal cavities externally through an accidental perforation of these sinuses, and deceive inattentive persons, inducing them to believe that this matter comes from within the cranium.* Such a mistake may likewise occur without any external opening of the sinus, where the liquid flows into the nose with the characters of pus from the cerebral substance. In the first case also, the air, by penetrating into the sinus, may communicate to the mucous membrane movements analogous to those of the brain, and thereby encourage the error.† This membrane, also, from its communication with the nasal cavities and its secretion, is considered as the cause of fistulæ which sometimes occur in this place in consequence of wounds or other diseases which have perforated the anterior wall of this sinus;—fistulæ which are difficult to cure, but not incurable, since Professor Dupuytren says that he has seen many of them cicatrise. From the unequal separation of the walls of the frontal sinus, it follows that we ought to avoid, if possible, trephining in this situation, because the crown of the instrument might lacerate the membranes of the brain in some points, before the section of the bone is completed. In an extreme case, however, it would be possible to remove the portion of bone without injuring the membranes, provided we use a trephine with a large crown, for sawing through the external table, and a smaller one for the internal, as has been advised by Professor Boyer and M. Lisfranc.

* Maréchal.

† M. Boyer.

The frontal sinuses sometimes extend as far as the external orbital process, and even as high as the os parietale, as observed by Ruysch, and twice by us;—this we should likewise bear in mind when called upon to trephine this bone. This latter disposition would prevent us from estimating the volume of the anterior parts of the brain from an external examination of the cranium. When pus or other fluids accumulate, or tumours form in the frontal sinuses, the posterior wall of these cavities being thinner than the anterior, it will yield first and thereby give rise to cerebral compression, &c. These cavities are wanting in certain individuals, as is said to be the case in the (*canus*) flat-nosed.

Above the preceding prominences, the os frontis presents a depression which corresponds to the cutaneous groove of the forehead; still higher, the frontal protuberance, which is more or less prominent in different subjects, which disposition may be owing to a greater degree of convexity of the bone at this part or increased thickness. In the latter case, after having been very prominent, it may become depressed in old age from absorption of the diploë.

In consequence of this structure we cannot penetrate the cranium by the frontal region without traversing the different layers which have just been pointed out, and of which the following is the order of superposition:

1st. The skin; 2d, the cellulo-adipose layer, which is dense and encloses the principal vessels; 3d, the muscles and aponeuroses, the internal frontal nerve, and some branches of the superciliary; 4th, the pericranium and some filaments of the latter nerve; 5th, the os frontis.

Sect. 2. Temporo-Parietal Region.

It is of a quadrangular form, and bounded, inferiorly, by a line drawn from the external orbital process along the superior border of the zygomatic arch, and terminating at the fore part of the mastoid process; superiorly, by the analogous region of the opposite side; anteriorly, by the external boundary of the frontal region: and, posteriorly, by a line extending from the anterior

part of the mastoid process to the junction of the sagittal with the lambdoidal suture.

Upon its surface we observe, between the ear and frontal region, above the zygoma, sometimes a convexity, at others a concavity, according to the embonpoint of the individual and the volume of the temporal muscle. Above the temporal fossa we find a broad and regularly circumscribed prominence: this is the parietal protuberance.

CONSTITUENT PARTS.

I. *The Skin.*

In the inferior part of the region this membrane is very thin, extensible, and but slightly adherent to the subjacent tissues. Anterior to the auricle, and in approximating the external orbital process, it becomes a little thicker, and is more intimately connected with the adipose layer; thus far, it is not generally covered with hair. As we trace it backwards and upwards, it gradually becomes thicker, and assumes the same characters with that of the upper part of the frontal region. The hairs which cover it are implanted into it obliquely, so that those in the centre descend towards the ear, the anterior to the forehead, and the posterior towards the neck. There are a great number of follicles at the roots of these hairs, which last turn gray sooner in this region than in any other: whence the name "*tempora*."

II. *The Cellulo-adipose Layer.*

It is generally thin, but becomes thicker as it descends: it lies upon a stronger layer of a fibro-cellular nature. The three small auricular muscles are included between the plates of the latter, or rest upon its external surface, and it is thicker behind than before. We may consider it as the fascia superficialis of the temporal region, and the superficial temporal vessels and nerves creep through its tissue. As it passes under the hairy scalp, it becomes blended with the dense and compact texture which separates the integuments from the epicranial aponeurosis.

III. *The Epicranial Aponeurosis.*

Above the temporal fossa it is strong, thick, firm and unyielding; its relations with the pericranium and skin are the same as in the frontal region; and, consequently, the same surgical remarks are applicable to it. Surgeons formerly supposed that this fibrous sheet was possessed of exquisite sensibility, and therefore attributed to it much of the severity of the symptoms which attend upon wounds of the head. Be this as it may, its dense and compact texture prevents morbid fluids from accumulating beneath it in the form of abscesses, hence they promptly diffuse themselves and produce denudation and even necrosis of the bone. When the cellular tissue beneath this becomes inflamed, the resistance which this aponeurosis affords to the subjacent phlegmonous tumefaction, accounts for the acute pains which then manifest themselves, and calls for the different incisions recommended in such cases.

Over the temporal fossa the aponeurosis is thinner; upon the zygomatic arch it is blended with the fascia superficialis, and passes into the parotideal region; it supports the branches of the superficial temporal and auricular arteries, &c. Downwards and forwards, it is perforated by the superficial temporal nerve of the fifth pair, and is, in general, somewhat firmly united to the temporal aponeurosis, although inferiorly it is separated from it by some adipose cells. About an inch behind the orbit and above the zygomatic arch, these two laminae are fixed to the temporal aponeurosis by a kind of pedicle, in which are one or more nervous filaments, and some arterial and venous twigs which come from the zygomatic fossa.

IV. *The Temporal Aponeurosis.*

This fascia is of an oval form, and is attached to the whole of the semicircular line of the temporal fossa: from the superior and posterior five-sixths of its internal surface muscular fibres originate; but the anterior and inferior sixth of its extent is separated from the muscle by a soft adipose tissue. Here, this membrane is bifoliate, and its two sheets are continuous with the periosteum covering the internal and external surfaces of the zygomatic arch.

These two laminae are separated by fat, which gives a prominence to the temporal region proportionate to its abundance; on the contrary, where this fat is absent there is a correspondent depression.

Inflammation is frequently excited in this adipo-cellular tissue, and when matter forms in consequence, we must give it an early exit, otherwise it will perforate the internal sheet of the aponeurosis, which is thinner than the external, and make its way into the zygomatic fossa. Anteriorly, towards the point where these two laminae unite, they are perforated by the pedicle just mentioned, when on the epicranial aponeurosis.

v. *The Muscles.*

The frontalis muscle sometimes advances a little into the superior part of this region; the three auriculares have already been noticed; the temporalis remains to be spoken of. As the fibres of this muscle converge towards the central tendon which embraces the coronoid process of the inferior maxillary bone, it is generally recommended, when about to apply the trephine, to make the incision in the form of the letter V, in order that their action may be preserved. This advice cannot be attended with danger, but the idea upon which it is founded does not seem to be correct; for, whether the fibres are cut transversely or parallel to their axis, a similar number, as the flap must be raised, will be divided; and, as we know that fleshy fibres, when once incised, always reunite by means of a fibrous cicatrix, the direction of the incision can then make but little difference.

vi. *The Arteries.*

We must examine especially the superficial temporal and its branches. Its trunk is situated between the epicranial aponeurosis and superficial fascia, and, as these fibro-cellular laminae are not very compact, if the artery was divided, and we wished to tie it in the temporal portion of this region, we would not experience the same difficulties as in the parietal portion. Above the zygomatic arch, the superficial temporal artery is situated about two or three lines anterior to the auricle, at which place it would be

very easy to open, or apply a ligature around it, if considered necessary. It is also useful to note this situation in order to avoid the application of caustic, moxa, cups, or leeches over this part, unless particular indications demand them, and to take all proper precautions. Perhaps it would be more prudent to perform arteriotomy a little higher up, because, the cellular tissue being more abundant here, inflammation would be more liable to ensue; compression would also be less immediate and more painful, on account of the aponeurosis being more remote from the bone, and finally on account of the proximity of the meatus auditorius externus.

The anterior branch of the superficial temporal passes to anastomose with the frontal, and the posterior with branches of the occipital; they often interosculate, thereby forming a complete net work which is always covered by the fascia superficialis and skin. These numerous anastomoses oblige us to tie or compress both extremities of the divided artery in order to arrest the hæmorrhage effectually; for if we obliterate but one of them, the blood will continue to flow from the other.

We likewise find in this region the middle temporal, which comes off from the trunk of the preceding on a level with the zygoma; it immediately perforates the external sheet of the temporal aponeurosis, in order to ramify in the adipo-cellular tissue which separates it from the internal, and afterwards, penetrating the latter, enters into the substance of the muscle, where it inosculates with the deep-seated temporals.

These last, arising from the internal maxillary, distribute their principal branches to the temporal muscle and the external surface of its central tendon; the others are applied upon the bones, where they meet with certain fissures, in which they become imbedded. The inosculation of the deep-seated anterior temporal with twigs which come from the orbit, may, in some measure, account for the pain which is sometimes experienced in the temporal fossa in consequence of diseases of the eye, and *vice versa*.

VII. *The Veins.*

There is at least one for each deep-seated artery. The ante-

rior branch of the temporal artery has none when the frontal vein exists. In this region we find a very large emissary vein which comes out of the cranium through the parietal foramen. We will recur to this when we come to speak of the bones.

VIII. *The Lymphatics.*

We are a little better acquainted with these vessels than with those of the frontal region; they generally accompany the arterial branches. The superficial set passes into the glands which surround the ear, the other to the deep-seated glands of the neck; whence certain authors have supposed that an engorgement of the subcutaneous lymphatic glands indicated disease of the skin or parts external to the temporal aponeurosis, whilst deeper seated affections gave rise to tumefaction of the intermuscular cervical glands.

IX. *The Nerves.*

These are very numerous, but of little importance as it regards operations: some of them are superficial, the others deep-seated. The former are derived, 1st, from the cervical plexus, which distributes branches to the skin and subjacent cellular tissue; 2d, from the facial, numerous filaments of which accompany the arteries in the fascia superficialis, and anastomose with the supra-orbital in the frontal region; 3d, from the auricular of the inferior maxillary: this branch, which is the superficial temporal, is anterior, and follows the same direction with the filaments of the facial, with which it freely inosculates.

The second originate, 1st, from the temporals of the inferior maxillary, and the temporal filament of the orbital branch of the superior maxillary; 2d, in the parietal portion of the region, from the anastomotic branches of the frontal, sub-occipital and sub-mastoid. From this simple enumeration, we see that a disease of the temple may give rise to pain in all parts of the head, and be repeated in the orbit, jaws, face, ears, neck, etc., and *vice versa*.

As to the nerves from the great sympathetic, they can only be traced upon the arteries, and their study is of no surgical importance.

x. *The Skeleton.*

We find in this region the whole of the squamous portion of the temporal bone, the temporal part of the great ala of the sphenoid, a very small portion of the os frontis, and almost the whole of the parietal. Sometimes the squamous portion of the bone is convex instead of being plane or concave; whence a greater prominence of the temple. At the junction of the sphenoid with the frontal, parietal, and temporal bones, we find the greatest depth of the temporal fossa. It is on account of the sutures which result from the junction of these different bones, and especially because the *Arteria Meningea Media* runs through a groove in the internal surface of the anterior and inferior parietal angle, that we are forbidden to apply the trephine at this part. It is true that the cases which would require a perforation of the cranium here must be very rare, because in this situation the meninges are firmly adherent to the bones: it is also true that the operation would be rendered difficult by the inequality of the surfaces and the thickness of the soft parts; but if the indication is positive, the situation of the artery should not deter us; for even if the artery should be wounded by the instrument, it would be very easy to compress it. The tenuity of the os temporis in this region, sufficiently explains the frequency of its fractures. We should bear in mind the situation and appearance of the squamous and other sutures, in order that we may avoid mistaking them for fissures, an error committed and pointed out by Hippocrates, and not unfrequently since his time. This remark is applicable to all points of the cranium.

The arched form of the parietal bone is the most variable as well as most remarkable appearance of the skeleton of the temporo-parietal region. Sometimes the parietal protuberance scarcely exists, whilst at others it is very prominent. In some subjects it is larger on one side than the other; hence a want of symmetry in the cranium. This irregular conformation is not infrequent, and is even present in men of the greatest talent, of which the celebrated Bichat and the learned Béclard have afforded examples. The bone is sometimes very thick at this point; so that the parietal projection does not always indicate an increased

capacity of the cranium. Here, senile atrophy most frequently manifests itself, and then, instead of a bump, we find an excavation. The parietal bone has sometimes acquired the hardness of ivory.*

The superficial situation of this bone subjects it to numerous diseases; nevertheless, its arched form renders it less liable to fractures from a direct cause, than it would otherwise be. In relation to the application of the trephine, we must recollect that the greatest thickness of the parietal bone corresponds to its protuberance; next, to the posterior and superior angle; then, to the inferior and posterior; after which comes the superior and anterior; and finally, the inferior and anterior angle, which is the thinnest. Between the parietal bump and sagittal suture, there are one or more foramina, situated nearer the posterior than the anterior part. These foramina communicate with the venous canals of the diploë, or with the sinuses of the dura mater, and give passage to emissary veins of considerable volume, which we have before referred to. It is by these veins that we are recommended to disgorge directly the sinuses, meninges, and brain, by applying leeches, etc., over the points corresponding to these vessels.*

The order of superposition in the temporal portion of this region is as follows: 1st, the skin; 2d, the cellulo-adipose layer; 3d, the fascia-superficialis, beneath which are the superficial vessels and nerves; 4th, the epicranial aponeurosis, separated from the preceding by nerves and vessels; 5th, the temporal aponeurosis; 6th, the temporal muscle; 7th, the pericranium; 8th, the bones.

In the parietal portion we only find, 1st, the skin; 2d, the fibro-adipose layer, which encloses the nerves and vessels; 3d, the epicranial aponeurosis; 4th, the pericranium; and 5th, the bones.

Sect. 3. Occipital Region.

Its figure resembles that of the frontal region: that is to say, supposing it to be flattened out, it is triangular. Its boundaries are, anteriorly, the preceding region; upon the median line, its

* M. Portal.

fellow of the opposite side ; inferiorly, a line extending from the apex of the mastoid process to the occipital protuberance.

CONSTITUENT PARTS.

I. *The Skin.*

Upon the mastoid process, this membrane is thin, smooth, shining, destitute of hairs, and participates in all the characters of that which covers the auricle ; as it ascends, it becomes considerably thicker and very dense. At the summit of the region, the hairs pierce it almost perpendicularly ; as they descend, more and more obliquely, and persist for a greater length of time in this than in the other regions.

II. *The Cellulo-adipose Layer.*

Behind the ear, it is altogether cellular ; throughout the rest of its extent we meet with minute adipose vesicles, which are enclosed in very compact fibro-cellular *loculi*, as in the frontal and parietal regions. Upon the occipital bone this layer is intimately adherent to the skin, for which reason wounds occurring here with loss of substance cannot be approximated ; neither by sutures, which would be dangerous, nor by bandages, which would be ineffectual. Upon the os temporis, as the adherence is slight, wounds may be immediately united. This layer encloses all the principal vessels and nerves ; its union with the subjacent layer is not less intimate than with the skin ; it is this compact union which renders the dissection of the occipito frontalis muscle and the epicranial aponeurosis so difficult ; and it is also for this reason that the skin which extends from the forehead to the occiput, follows all the movements produced by the contractions of this muscle.

III. *The Aponeurosis and Muscles.*

The former is very strong ; its fibres are very distinct in this region, and in some subjects it puts on a shining and pearly appearance. The latter are ;—the posterior auricular, which at-

taches the auricle to the mastoid process; then the occipital, which covers only the two external thirds of the bone, so that above the occipital protuberance the aponeurosis alone is situated between the pericranium and subcutaneous layer. These parts are separated from the pericranium by a dense, but not very compact, lamellated cellular tissue. The superior extremities of the sterno-mastoid and splenius capitis muscles, although not specially appertaining to this region, must nevertheless be noticed, because their attachments near the mastoid process and insertion into its apex, expose them to injury when operations are performed at this part; as for example in perforating the cells of the mastoid.

iv. *The Pericranium.*

It presents nothing peculiar here, unless it is that it adheres more firmly to the bones, on account of the roughness of their surface.

v. *The Arteries.*

The most important are the occipital and posterior auricular. The former enters this region as it passes from between the splenius and trapezius muscles, and then goes to inosculate with the posterior branch of the temporal; it is enveloped in the subcutaneous layer, and is very difficult to secure by ligature. The second slides along the mastoido-auricular furrow, enters the posterior auricular muscle and the deep fibrous tissue, gets above the mastoid process and anastomoses with the preceding. It follows, from this distribution of these arteries, that wounds, or incisions made in the internal and superior third of this region, will not be attended with hæmorrhage; the same applies to the mastoidien eminence, unless the division is made very near to the ear.

We should likewise notice the small branch of the occipital artery, which passes to the dura mater through the foramen mastoideum posterius.

vi. *The Veins.*

There is at least one, and often two, for each artery; they follow exactly the same course, and empty their blood into the jugu-

lars. Besides these, we find numerous emissary veins coming out at the lambdoidal, mastoido-parietal and mastoido-occipital sutures, and especially one of very large size, which comes through the mastoid foramen. This last frequently communicates with the venous canals of the diploë, and always with the lateral sinus: on this account, we are advised to apply leeches, cupping glasses, etc. over it, in order to remove congestion of the meninges promptly.

VII. *The Lymphatics.*

The superficial pass to the posterior glands of the ear; the deep-seated under the sterno-mastoid muscle.

VIII. *The Nerves.*

These are numerous, and originate, 1st, from the posterior auricular branch given off by the facial, as it emerges from the stylo-mastoid foramen; this nerve generally divides in like manner with the artery of the same name; 2d, from the sub-mastoid branch of the cervical plexus; this branch ramifies in the subcutaneous tissue, and is distributed principally to the skin; it anastomoses with the anterior auricular of the same plexus, with filaments from the internal frontal and sub-occipital; 3d, we find some twigs from the first cervical pair, and the posterior branch of the sub-occipital. The latter accompany the vessels, and ramify in the occipital muscle, aponeurosis and pericranium, and inosculate with the preceding, but especially with the frontal. From this abundant supply of nerves, and the density of the cellular tissue in which they creep, we may explain the symptoms which accompany inflammations of this part of the head, and those which follow operations performed upon it. Their anastomoses will also teach us why neuralgia of a certain point of the cranium is not always removed by the section of the principal nerve distributed to it; and they further account for the rapidity with which pain and inflammation spread from the occipital region to all the other parts of the head and neck. It may be well to note, however, that the return of pain, after a nervous branch has been di-

vided, may be owing to the possible re-union of its divided extremities, as well as to anastomosis.

The ganglionic system does not furnish any distinct branch to this region; all the filaments which come from it are imbedded in the arterial tunics.

IX. *The Skeleton.*

It consists of the mastoid portion of the temporal bone, the inferior angle of the parietal, a portion of the occipital, and the sutures which unite these osseous pieces.

Each of these portions of bone present certain peculiarities worthy of notice. Thus the ossa wormiens, which frequently occur in the lambdoidal suture, may be mistaken for fractures; as also the anormal suture which separates into two the *epactal* and *proral* portions of the os occipitis, upon the median line. The existence of this separation in the adult likewise renders the longitudinal sinus more liable to rupture.

The portion of the os occipitis appertaining to this region, corresponds to the posterior lobe of the cerebrum. If it is true, therefore, as M. Gall supposes, that the organ of maternal love resides in this portion of the brain, we will readily conceive why this part of the cranium is more prominent in the female than the male, and why wounds or fractures here have sometimes been followed by a decided change in this faculty. Further, the application of the trephine should always be made in preference upon the middle of the lateral prominence of the occiput, because there the bone is very thin, whereas in the surrounding parts it is much thicker. The presence of the occipito-parietal suture externally, of the longitudinal sinus internally, and of the lateral sinus inferiorly, opposite to the superior curved line, is an additional reason in favour of this precept. Neither should we trephine upon the posterior and inferior angle of the parietal bone, because it corresponds to the place where the lateral sinus turns behind the petrous portion of the os temporis. It is at the junction of this angle with the other bones that we find a fontanelle in the fœtus, which may remain during childhood. Herniæ of the cerebellum have protruded at this part, and we can conceive the possibility of them: those of the cerebrum may also occur here.

The mastoidien portion of the temporal bone likewise deserves

very particular attention. In the first place, we should distinguish from the mastoid process, properly so called, the posterior and superior part of the bone, which is thin, and corresponds to the lateral gutter. This mammoid eminence is subject to numerous varieties, with which it is useful to be acquainted. It is much less prominent in the infant than the adult, in the female than the male, and more so in old men; its developement almost always depends upon the cells which it encloses, and through which it communicates with the cavity of the tympanum; for which reason the mastoid process has been perforated in order to give exit to pus, or other fluids extravasated in this cavity, as well as to admit of the entrance of air into it. We must recollect, however, that this operation is not admissible in children, in whom the mastoid cells are not developed; that sometimes the paries of the mastoid cavity is very thick, and formed of two compact laminæ with an intermediate diploë, which would prevent our arriving at the cells readily; that, in other cases, this wall is as hard as ivory; and finally, that instances have occurred in which the cells were small, compact and having no communication with the ear. In cases where the mastoid cells are very large and their parietes thin, we should not forget that they may be fractured independent of the cranial table.

In fine, it is evident that the mastoidien portion of the occipital region deserves the greatest attention, on account of the numerous diseases to which it is subject. Indeed, nature herself sometimes accomplishes the perforation of the bone in order to give issue to pus accumulated within the ear, and caries and necrosis of this process is no unfrequent occurrence. The structure and arrangement of the tissues render inflammations in this situation dangerous. This region is sometimes the seat of tumours arising either from tumefaction of the lymphatic glands which appertain to it, or morbid changes of some other nature; finally it is at this point we apply leeches, cupping glasses, the moxa blisters, etc., for a great variety of diseases.

In proceeding from the surface towards the bones we find the parts in the following order of superposition: 1st. the skin; 2d. the cellulo-adipose layer, enclosing the nerves and principal vessels; 3d. the epicranial aponeurosis and muscles; 4th. the pericranium; 5th. the skeleton.

Sect. 4. The Cranium in General.

There are some remarks applicable to all the regions before treated of, into the detail of which we must now enter.

1st. The density of the skin, the hairs and the numerous follicles which surround their roots, appear to be the principal reasons for the peculiar character which the different species of *Tineæ* assume.

2d. It is on account of the slight extensibility of the skin that tumours developed between the aponeurosis and integuments are always more or less flattened in their commencement.

3d. From the great thickness of the skin, and its intimate adhesion to the subjacent tissues, it follows that, after contusions, when the extravasated matters become fluid, we feel a depression in the centre of the swelling. This depression is sometimes so striking that it has deceived skilful surgeons, who have mistaken it for a disease of the bone, and even for a fracture.*

4th. The compact texture of all the parts covering the bones of the cranium sufficiently explains why its inflammations almost always assume the erysipelatous form; why its ulcers are of difficult cure; why wounds of the scalp, with the least loss of substance, are seldom susceptible of immediate reunion; and finally, when these wounds suppurate, why the pericranium becomes detached, and permits the matter to penetrate between it and the bones, thus giving rise to necrosis, etc.

5th. The tenuity of the bones in a great number of places, and the frequent vascular communications between the external and internal parts of the cranium, account for the severity of most of their external diseases, by the facility with which they are transmitted to the interior.

6th. There are a great number of points upon the cranium where surgeons are forbidden to apply the trephine, many of which have been already noticed; but it remains to speak of the sutures in general.

We do not trephine over their track; 1st. because it is difficult to separate the soft parts from them; 2d. because they adhere firmly to the *dura mater*; 3d. because they generally trans-

* See J. L. Petit.

mit emissary veins of considerable volume; 4th. because their serræ are unequal and converted into ossa wormiens; 5th. because the most remarkable of them correspond to large sinuses. But the experience of Garengot, Sharp, Marchettis, Warner, Pott, &c. shews us that this last motive should not deter us when the indications are positive.

It is evident that the most of these anatomical particulars must render this operation very rare, if we expect to derive benefit from it by trephining over these points. However, in consequence of the adhesion of the dura mater to the sutures it is difficult for fluids to become extravasated beneath them; but if this extravasation has already taken place, the dura mater is then detached, and then it occasions no particular impediment. It is only in those cases where the extravasation exists between the meninges that this separation is not effected, but under such circumstances it is never indispensable to trephine over the sutures.

7th. Although the osseous box of the cranium encloses the most delicate organ of the economy, it has been destroyed in a great number of points, either by repeated trepanations* or by diseases,† without death being the necessary consequence.

8th. The fontanelles must also be noticed. Those which are seen at the inferior part of the temporo-parietal regions, generally disappear early in the fœtus: they afford no assistance during parturition; but, as we have already stated, hernia cerebri may protrude through these membranous spaces. Criminals have sometimes introduced needles, and other instruments, through these spaces, into the skulls of young children, in order to destroy them.

The anterior is the largest, and most constant; it is rhomboidal, and the four sutures which run into it cross each other at right angles, which distinguishes it from the occipital fontanelle, of which we shall speak presently. The frontal fontanelle being better known than the others, it has been supposed that pins, and other slender foreign bodies, found by some surgeons within the cranial cavity, without any trace of external aperture, have been introduced into it at this part.‡ It has been found open in a

* Quesnoy, Petit. † Lacharière, Prof. Richerand, M. Paillard.

‡ Valentin, *Voyage en Italie, etc.*, Manne, *Bulletin de la Société médicale d'Emulation*, Mai 1810.

young man of twenty,* and in another of thirty years of age.† The continuance of this deficiency exposes the subject of it to encephalocoele, and it is for the purpose of preventing such an occurrence, as well as injury from external agents, that quilted caps of various constructions have been recommended.

The posterior fontanelle is frequently closed at birth, notwithstanding it is of greater importance, as it regards paturition, than the preceding, since it is uniformly found in the centre of the part which generally presents: we distinguish it by its being of smaller size, its triangular form, and especially by the three branches of sutures which converge towards it. The direction of these lines is, in fact, the sole index upon which we can depend in order to ascertain when the angle of the occipital bone is not ossified, or when the sagittal suture is prolonged towards the foramen magnum, dividing this bone into two symmetrical portions.

9th. From the manner in which the different bones of the cranium are arranged, an ovate or spheroidal box is formed, which resists external violence after the manner of arches, according to Bertin, and of spheres, according to Béclard.

ART. II.—OF THE FACE.

We may divide this part of the head into parotideal, nasal, orbital, zygomato-maxillary, masseterine, genian, mental, labial, olfactive, buccal and pharyngeal regions.

Sect. 1.—Parotideal Region.

As this region does not appertain, properly speaking, either to the cranium or neck, we have preferred connecting it with the face.

Its form is pyramidal, the base of the pyramid corresponding with the skin, its apex to the pharynx. It is bounded, superiorly, by the temporal region; posteriorly, by the anterior margin of the sterno-mastoid muscle; anteriorly, by the posterior border of the inferior maxillary bone, and inferiorly by a line drawn from the angle of the jaw across the sterno-mastoid muscle.

* Bauhin. † Bartholine.

Its surface presents a gutter which is deeper in the aged, in men, adults, and those of a spare habit, than in children, women and those who are corpulent. This gutter is continued downwards into the supra-hyoideal region; upwards, to the lobe of the ear; afterwards, in passing between the auricle and mastoid process, it forms only a simple furrow which was spoken of when on the occipital region: this is the mastoido-auricular furrow.

We feel, in the parotideal region, quite near the anterior aspect of the tragus, a small prominence which is carried forwards when we depress the jaw; this is the maxillary condyle. When the mouth is shut, there exists between this prominence and the masseter, in emaciated persons who have not a very large parotid, a slight excavation. This depression corresponds to the posterior part of the sigmoid notch of the jaw, and at this part we might easily introduce a pointed instrument into the zygomatic fossa. From this superficial situation of the condyle, its fractures may be easily detected, by pressing the finger upon it, and at the same time depressing the jaw.

CONSTITUENT PARTS.

I. *The Skin.*

This membrane is delicate, supple, and destitute of hairs; it contains numerous sebaceous follicles, and may be easily raised by tumours forming beneath it, without yielding however to any very considerable distension.

II. *The Subcutaneous Layer.*

It is composed of a few fibres of the platysma, and a pretty dense cellular layer, the characters of which will be more particularly investigated, when we speak of the masseterine region. In the superior part of this region we have in the first place the ear, which requires a distinct examination. This delicate organ is susceptible of surgical considerations in its external and middle portions only. we will therefore speak but little of the internal ear.

III. *The External Ear.*

It is divided into the Auricle and Meatus Auditorius Externus.

The Auricle commences at the concha, is of an oval form, its largest extremity being placed upwards, and so situated that its superior half rests upon the temporal region, that its posterior part conceals the mastoid process, and that its anterior and inferior portion alone is placed in the parotideal region. It is composed, 1st, of a very delicate and thin skin, which slides easily over the subjacent tissues; this skin is smooth throughout, excepting within the tragus and antitragus, where a few hairs are generally observed; it encloses numerous follicles, in which the sebaceous matter sometimes accumulates and concretes, forming small encysted tumours (*loupes*) known by the name of *tannes* (acne punctata). Where the auricle attaches itself to the temple by means of the helix, and upon the face by means of the lobe, it forms two distinct folds. 2d. Of a cellulo-fibrous layer, very dense, but lamellated, separated from the cutaneous envelope by a more supple cellular tissue, in which adipose vesicles are never met with. When small purulent abscesses form in this last layer, they excite but little pain, but sometimes burrow with great rapidity under the skin, giving rise to intractable sinuous ulcers. When, on the contrary, these abscesses are developed in the former tissue, they occasion very acute pain and sometimes very formidable symptoms: 3d, of the five small muscles of the auricle; viz.: the helix major and minor, the tragus, antitragus, and transversus auriculæ: 4th, of arteries, which are, the posterior auricular, derived from the external carotid, and the anterior auriculares, from the superficial temporal: 5th, of veins which accompany the arteries: 6th, of lymphatic vessels which are rather supposed to exist in it; their injection being rendered so difficult by the closeness of the cellular tissue in which they are enveloped, that they have not as yet been discovered but by very few anatomists. These lymphatics, according to Mascagni and Cruikshank, pass to the parotideal absorbent glands, and the tumefaction which these glands undergo in consequence of certain diseases of the external ear, seems to support this opinion: 7th, of numerous nerves, which are, in the first place, anteriorly, the superficial temporal, originating from the inferior maxillary; the auricular

branch of the cervical plexus ; next, posteriorly, the mastoid branch from the facial, which we have already seen in the occipital region, and lastly, the sub-mastoid branch from the cervical plexus. This ample supply of nerves accounts for the acute sensibility of the external ear, and the symptoms which its inflammations usually excite in it : Stl, of a cartilage, which is enveloped in a very dense species of perichondrium, so much so that Bichat has classed this substance among the fibro-cartilages. It constitutes the solid parts of the auricle, and determines its form, eminences, depressions, etc. It is very flexible, which defends it from being fractured, unless it has become ossified by age, which is a very rare occurrence.

Although the lobe contains almost all the elements which have just been passed in review, yet these diverse tissues present certain differences worthy of notice. Thus, the skin is equally delicate, but more freely supplied with venous capillaries ; hence the livid colour it assumes on exposure to cold, or when respiration and circulation are impeded. Its cellular tissue contains very small adipose vesicles, and these different parts are so much confounded with the vessels, nerves, and skin, that the lobe seems to form a homogeneous mass, rather than a complex organ. As this part of the auricle possesses but little sensible tissue, its perforation is scarcely painful.

The meatus auditorius externus is about an inch in length, and its direction obliquely inwards, downwards and forwards ; when cut across, its figure is elliptical, its perpendicular diameter being greater than its antero-posterior. It is so situated, that it touches the maxillary condyle anteriorly, whereby, when the jaw is depressed, this canal is dilated. It is for this reason, says M. Riche-
rand, that we instinctively open the mouth the better to distinguish sounds which we are anxious to hear. Posteriorly, it lies upon the mastoid process, and superiorly, it is circumscribed by the superior branch of the horizontal root of the zygomatic process.

From what has just been said, it follows that in the two last directions, the meatus auditorius externus is securely protected by the bones ; whilst inferiorly, it is almost uncovered. The disposition of this canal is such, that forwards and downwards its parietes are concave, and two lines longer than upwards and backwards, where they are convex. This difference in length is

produced by the membrana tympani, which is inclined obliquely inwards and forwards. From these data, the principle of passing instruments along the inferior paries of the canal, when we wish to extract foreign bodies from the ear, is derived. This canal is hollowed out in the os temporis, where it receives a prolongation of the auricle; but the elements of this auricle here present some peculiarities which should be mentioned. In the first place, the skin gradually loses its characters, so that as it approximates the membrana tympani, the epidermis alone remains, which terminates in a *cul-de-sac* upon this membrane; next the follicles are numerous, and secrete the cerumen, which sometimes accumulates and hardens, producing deafness, especially in the aged; and finally a considerable number of hairs are implanted into it, which seem destined to catch minute particles of dust, etc., propelled by the air towards the tympanum.

The cartilage of the meatus is, as it were, incised from space to space by what are called the *incisures of Santorini*, and these fissures permit purulent matter, formed in the vicinity, to make its way into the auditory canal. One of these fissures is met with in the superior and posterior part, quite near the anti-tragus; another, which is more distinct, upwards and forwards, between the helix and tragus. The fibrous tissue, which alone fills these fissures, may be destroyed by the pus of superficial abscesses; and hence be discharged through the meatus. We have but recently met with a case of this kind: on the 22d of March, 1825, Mr. G....., who had laboured under a pustular inflammation of the intestines during twenty-five days, was attacked with parotitis, and six days afterwards, the matter made its way into the ear through the last mentioned fissure. Besides the arteries already mentioned when on the auricle, the meatus auditorius receives branches from the stylo-mastoidea (*auricularis posterior*) and from the temporalis profunda posterior. The veins are of no importance in a surgical point of view. The same may be said of the nerves: we sometimes find here, however, a filament from the great sympathetic, running to anastomose with the facial.

IV. *The Middle Ear or Tympanum*

The cavity of the tympanum may be considered as a dilata-

tion of the preceding canal, from which it is separated only by a thin and fragile membrane. Below this box we find the glenoid cavity: anteriorly and a little more internally it corresponds to the carotic canal; which may, in some measure, account for the buzzing in the ears which patients with aneurism of the internal carotid sometimes experience. From its relations with the fissure of Glaser, blood, pus, &c., may penetrate from the cavity of the tympanum into the temporo-maxillary articulation.

The mastoid process and cells are situated posterior and external to the tympanum, and as the cells are separated from this cavity only by the mucous membrane of the latter, we conceive that abscesses of the ear may be evacuated through a perforation made in this process. The superior wall of the middle ear is thin, and corresponds to the anterior aspect of the petrous portion of the os temporis. Vascular porosities are observed in it, which form a communication between the dura mater and the mucous membrane of the tympanum. We also see here, in the child, and sometimes in the adult, a trace of suture which transmits cellulous processes and emissary veins: this disposition accounts for inflammation of the meninges arising from acute otitis, discharges of blood from the ears after blows or falls upon the head, and tinnitus aurium in diseases of the brain, &c.

The external paries of the cavity is formed by the membrana tympani, a species of horny lamina, covered externally by the cuticle of the meatus and, internally, by the mucous lining of the tympanum. According to Rivinus, Scarpa, Witteman, Vest, &c., it is naturally perforated; but this perforation is probably only an anomaly or an accidental occurrence. Be this as it may, when this state exists, we can readily comprehend how gaseous or other fluids, such as tobacco-smoke, air, blood, &c. may be propelled from the mouth through the ear. In general this does not impair the hearing, unless accompanied with a diseased state of this organ. The manubrium of the malleus is fixed between the laminae of the membrana tympani, a little below and before its centre; and it is for this reason that the operation recently advised by Portal, Cooper, &c., for the cure of certain forms of deafness should be performed low down and upon the

anterior half of this membrane. This remark is equally applicable to any other perforations of the membrana tympani which diseases of the ear may require. We should always be careful, in performing these operations, not to introduce the instrument too far, lest we wound the chorda tympani, which comes from the posterior paries of the cavity in order to pass out at the glenoid fissure. The opening of the Eustachian tube is at the inner and fore part of this cavity. This canal, which is of great importance in surgical practice, on account of the frequency of its diseases and the operations which they require, runs obliquely forwards and inwards, between the petrous and squamous portions of the temporal bone, towards the top of the pharynx, where it terminates behind the opening of the nasal fossæ. Its dimensions generally increase as it passes from the tympanum towards the pharynx, which renders easy the introduction of a probe from the nostrils; but we will have occasion to speak of this again.

The internal membrane of the middle ear is a prolongation of that of the pharynx; it is thin, but very distinct in some persons, especially towards the mastoid cells. It envelopes the whole chain of bones, but does not penetrate into the labyrinth, on account of the horny plates which close the fenestræ rotunda et ovalis; and its nature renders it susceptible to the same diseases with the mucous membrane of the pharynx. The cellular tissue which connects it to the bones is very compact; we may consider it as a species of internal periosteum, and from its density we may comprehend why inflammations of the ear are so painful. The membrane which lines the cavity of the tympanum receives its arteries from the stylo-mastoidea. The internal carotid gives off some twigs to the soft parts of this cavity which pass through a small distinct foramen; finally, it receives some from the meningea media, by the canal which lodges the tensor tympani, and from the maxillaria interna by the fissure of Glaser.

The veins follow exactly the course of the arteries, and afford no interest here. We have already mentioned what we had to say respecting them when treating of the emissary veins of the superior paries; like all other emissary veins they are destitute of valves, and empty their blood into the dura-matral sinuses.

The lymphatic vessels have never been injected.

The nerves of the middle ear appertain to the facial, the carotic plexus and the spheno-palatine ganglion; from which result complicated anastomoses, which may explain why diseases of the internal ear excite such a variety of sympathetic affections. We have already spoken of the chorda tympani which comes from the vidian nerve.* If we consider that this chord, in crossing the tympanum, passes above the malleus, it will afford us an additional reason for perforating the membrani tympani at its inferior part.

The internal ear having no relation with surgery, we do not consider it our duty to speak of it.

V. *The Parotid.*

Next to the ear we find the gland from which the parotideal region derive its name. This organ covers, anteriorly, the posterior margin of the jaw, and is prolonged more or less upon its external surface. Between this bone and the gland, we find, from above downwards, the superficial temporal artery and vein; then the facial nerve, which crosses the vessels opposite the neck of the condyle, imbedded in the deep granules of the gland; next the facial or transverse facial arteries; several veins of considerable volume, which ramify in the secretory tissue; finally the cervico-facial branch of the respiratory nerve of the face, (*portio dura*), the termination of the stylo-maxillary ligament, and the masseter.

Posteriorly, the parotid gland is somewhat firmly fixed, from above downwards, and from before backwards,—first, to the auditory canal, then to the fore part of the mastoid process and the anterior edge of the sterno-mastoid muscle; between the ear and the mammoid process it covers the posterior auricular artery; upon the apex of this apophysis, and externally, it lies upon another artery, which is sometimes larger than the preceding.

Internally or deeply, it rests upon the trunk of the facial nerve and the three filaments which are detached from it at its exit from the stylo-mastoid foramen; then upon the styloid process and the musculo-fibrous bundle arising from it; upon the digastric muscle, then, a little farther forwards, upon the styloidien ar-

* M. H. Cloquet.

tery, upon many anonymous twigs which penetrate the glandular lobules, and are lost in their substance; upon the trunk even of the external carotid, behind which the gland sends a process which sometimes dips very deep, and is applied upon the glosso-pharyngeal nerve, the internal jugular, and internal carotid. It is this last lobule which presented so many difficulties to Prof. Béclard when he extirpated the parotid in 1823. In this situation, the gland and the arteries are so intimately connected, that it is almost impossible to remove the one without wounding the others. The occipital and inferior pharyngeal arteries are likewise covered by the parotid, which, on the other hand, is finally prolonged between the pterygoid muscles and the styloid process as far as the pharynx, passing between the external carotid and the stylo-maxillary ligament. In the latter direction, this gland is continuous with the submaxillary.

These are the complicated, numerous, and important relations, which render the total extirpation of the parotid so dangerous and almost impossible; and hence we are induced to affirm, that this gland was never completely extirpated, previous to the operation by Béclard.*

It is evident that this operation cannot be terminated without applying a ligature to the external carotid; the facial nerve would necessarily be removed; in seeking for the deep prolongation of the gland, there would be the greatest danger of wounding the internal carotid artery; so with the internal jugular, the occipital, superficial temporal, and internal maxillary arteries. It is possible, however, that these last organs might be avoided if the parts remained in their natural relations. But what disease of the parotid is there, sufficiently severe to demand its extirpation, which will not derange the relative position of these organs? All the lobules of the gland are separately enveloped in a small cellular sac of considerable density; and are united together by a filamentous tissue of still greater density. It is in this tissue that critical inflammations of the parotid appear to have their seat, whilst the *mumps* affect more particularly the glandular element. The entire gland is afterwards enclosed in a species of fibrous envelope, the external and firmest lamina of which is derived

* *Archives générales de Médecine.* Janvier, 1824. Observation de M. Béclard, par M. Bérard.

from the aponeurosis which covers the sterno-mastoid and temporal muscles, and is continued over the external surface of the masseter. The internal or deep lamina also comes from the same parts; but is more irregularly distributed; it furnishes sheaths for all the vessels, envelopes all the processes which this gland sends between the muscles, and unites, anterior to it, with the external aponeurotic lamina. Above and external to the digastric muscle, these two laminæ are continuous with the fascia cervicalis and the stylo-maxillary ligament. Finally, behind the angle of the jaw, and on the inner side of the pterygoideus internus muscle, they pass from the parotid to the submaxillary gland, to which they equally furnish a sheath.

From the compact structure of the elements which unite and envelope the parotideal granulations, we may account for the severity of their acute inflammations, and the tendency of these inflammations to terminate by induration; also, when suppuration has taken place in them, for the difficulty with which the pus accumulates in the form of abscess; for the difficulty of detecting these abscesses when situated beneath the aponeurosis; and for their disposition, in certain cases, to penetrate towards deep-seated parts, such as the pharynx, tongue, etc., or towards the auditory canal, into which they as frequently open, rather than towards the skin. The very wise precept, of making an early opening into tumours of the parotideal region, in which we suspect the presence of pus, is founded upon these considerations.* The parotid is separated from the skin by a layer of cellular tissue, generally of considerable density, including some fibres of the platysma, nervous filaments of the facial, an ascending branch of the cervical plexus, and sometimes venous branches which pass to the external jugular. This layer seldom contains fat; it adheres firmly to the gland and integuments, for which reason tumours which form in it enlarge with difficulty, and generally possess but little mobility.

VI. *The Muscles.*

They are of but little importance here, in relation to practical surgery. In addition to those which form the limits of the re-

* Colles *Surgical Anatomy*, page 132

gion, we find posteriorly, between the sterno-mastoid and the origin of the digastric, the complexus minor; upon the spine, the rectus capitis lateralis, rectus capitis anticus major and minor; internally, the stylo-hyoideus, stylo-glossus, and stylo-pharyngeus, between which the gland sends, as we have said, prolongations, so that they are liable to be divided during the extirpation of this organ; a circumstance which would not fail to derange, in a serious manner, the functions of the larynx, tongue, and pharynx. More deeply, the constrictor pharyngæus, and anteriorly the pterygoid muscles, are the only ones which we here observe. A little lower down, inwards and backwards, we see the stylo-maxillary ligament, which we should avoid in operations, on account of its relations with the stylo-glossus muscle and its attachment to the os hyoides.

VII. *The Arteries.*

These are large and numerous. We find here the trunks of the two carotids, and the greater part of the branches given off by the external; viz. the occipital, pharyngeal, stylo-mastoideal, the commencement of the external maxillary and of the superficial temporal, the transverse facial, etc.

1st. The *External Carotid* at first placed very deeply within, on a level with, and a little above, the digastric and stylo-hyoid muscles, afterwards ascends, in order to arrive behind the condyle of the jaw, forming an arch which is convex externally. In this last direction, as well as posteriorly, it is enveloped by the gland, to which it firmly adheres; anteriorly, it is separated from the posterior border of the maxillary bone by a vein of considerable size; the cervico-facial branch of the seventh pair crosses it obliquely outwards, in its course to the face and neck.

2d. The *internal maxillary* separates from the carotid on a level with the neck of the condyle, about one inch and three quarters above the angle of the jaw; posteriorly and internally, it is only contiguous to the parotid gland; anteriorly, it makes a sudden turn under the neck of the maxillary bone, and plunges between the pterygoid muscles; whence it follows that, in fractures of this neck, the artery may be ruptured and occasion a troublesome hæmorrhage.

3d. The *superficial temporal*, in ascending, inclines more and more outwardly, as far as the anterior part of the meatus auditorius. Anteriorly, it is separated from the condyle only by its superficial vein and by dense cellular tissue; posteriorly and externally, it is covered first by the parotid, then by the skin and the fore-part of the auditory canal. It lies so near the skin that it may be tied, should circumstances require it.

4th. The *occipital* lies deep in the lower part of the region: it is at first situated behind and internal to the stylo-hyoid muscle; then it passes between the internal jugular vein, which it crosses nearly at a right angle, and the digastric, in order to arrive at the internal surface of the sterno-mastoid muscle. It does not adhere firmly to the gland, so that it would not hinder the removal of this organ.

5th. The *stylo-mastoideal* ascends almost perpendicularly towards the foramen of the same name: it is separated from the preceding, which is internal to it, by the stylo-hyoid muscle, and from the external carotid, which is before it, by a prolongation of the parotid gland. The posterior auricular branch, which originates from this artery about an inch below the stylo-mastoid foramen, is obliged to pass through the glandular tissue, in order to arrive at the mastoido-auricular furrow. It is this which is most exposed to the action of the instrument when we endeavor to divide the facial nerve at its exit from the cranium.

6th. The *transverse facial arteries* adhere so firmly to the parotid behind the masseter, that it is scarcely possible to separate them upon the living subject, when performing operations at this part.

7th. A considerable number of anonymous arteries, branches of the preceding, are also scattered throughout the gland, constituting its vasa propria; but none of them are so regular or large as to merit particular notice.

VIII. *The Veins.*

In general, the veins accompany the arteries and possess the same relations; but there is also an additional number of branches at the surface and in the substance of the gland, which unite together externally, in order to form the external jugular: besides,

we find, in the inferior part of this region, the anastomotic branch of the two large veins in the neck.

The internal jugular vein lies deep upon the fore part of the transverse processes of the first three cervical vertebræ, posterior and internal to the styloid process and the muscles which arise from it, to the parotid gland and all the arteries, with the exception of the internal carotid, which is upon its pharyngeal side. It is crossed in this place by the ninth (hypoglossal) and spinal accessory nerves. Its relations with the anterior cerebral artery, the great sympathetic and par vagum, are similar to those which we will find in the neck.

IX. *The Nerves.*

In the subcutaneous layer, we find the anterior auricular nerve of the cervical plexus, which is hard and its branches flattened. The principal branch of this nerve runs along the external jugular vein.

The spinal or accessory nerve is deeply situated, and at first runs obliquely between the internal jugular vein and the digastric muscle; it then traverses the posterior and inferior lobules of the gland, in its way to perforate the sterno-mastoid muscle.

Still deeper we find the glossol-pharyngeal and hypoglossal (*9th pair*) nerves: one of which is situated within, the other without, but both anterior to the internal jugular vein and internal carotid.

The pneumo-gastric (par vagum) nerve descends behind these two vessels and gives off its pharyngeal branch in this region.

Still nearer the bones, is the superior cervical ganglion of the great sympathetic, and the filaments which go to form the carotid plexus.

Finally, the important nerve of this region is the facial (*portio dura*.) After coming through the stylo-mastoid foramen, previously having given off its three twigs, this trunk descends obliquely outwards and forwards through the deep lobules of the parotid, before the mastoid process. It is at this point we must divide it, if we wish to suspend its action or remove neuralgic symptoms. This may be done without difficulty by making an incision from the back of the ear to the lowest part of this pro-

cess, from which we must separate the gland by drawing the anterior lip of the wound forcibly forwards, then dissecting cautiously, we will find the nerve at the depth of about six lines, in the middle of the space which separates the fibrous canal of the ear from the apex of the mammoid process. As the posterior auricular and submastoid arteries are situated directly upon this eminence, we will readily avoid them by inclining the incision a little further forwards.

It is in passing through the parotid in order to arrive at the external part of the superficial carotid that the portio-dura divides into two branches: the temporo-facial then ascends in a direction which, if continued, would reach the middle of the zygomatic arch, and it is so situated in this track, that it may be easily discovered by making an incision three or four lines in front of the ear. We would have to divide the skin, aponeurosis, and the parotid itself, which is thin at this part; the nerve will then be found anterior to the union of the lobe of the ear with the skin of the face; that is to say, eight lines below the horizontal root of the zygomatic process, upon the neck of the condyle of the lower jaw. We must be careful to cut obliquely from above downwards, and from before backwards, in order to avoid the temporal artery; we have also to apprehend, in endeavouring to make a section of this nerve, the wounding of the transverse facial arteries. It would not be difficult, however, to compress them against the masseter. We may remark that after the section of this nerve its action is not necessarily destroyed, since the cervico-facial branch remains. On this account, it is preferable to operate anterior to the mastoid process, if we do not wish to see the pains continue or re-appear, as has happened in two patients operated upon by Prof. Roux.

We will examine the cervico-facial branch in the supra-hyoideal region.

x. *The Lymphatics.*

These vessels are numerous in the parotideal region, and their glands deserve particular attention, because they receive almost all the lymphatics from the exterior of the cranium, and some of those of the face, mouth and pharynx. Some of these glands

are superficially situated upon the external surface of the parotid; others more deeply, between it and the different tissues of this region; we generally meet with two or three before or below the mastoid process. The frequent tumefaction of these bodies, in consequence of disease of the skin, of the cranium, or of the sides of the face, has often led to the necessity of removing them, and we are induced to believe that the cases of extirpation of the parotid, related by authors, were nothing more.

Finally, there are some glands situated between the sternomastoid muscle and the internal jugular vein, which form the commencement of the submastoideal cervical chain. These last receive their vessels from the deep-seated parts, and may, when enlarged, be mistaken for aneurism, compress the vessels, and produce serious consequences.

XI. *The Skeleton.*

The bones of this region are only met with superiorly, posteriorly, and anteriorly.

In the first direction, we observe the inferior surface of the petrous portion of the temporal, the glenoid cavity and foramen caroticum; then the occipito-petrous suture, in the posterior part of which is the foramen lacerum posterius, which gives passage to the internal jugular vein, the spinal accessory nerve, and par vagum; then the basiliary process, into which the anterior recti capitis muscles are inserted; posteriorly the anterior condyloid hole for the transmission of the ninth pair; the stylo-mastoid foramen for the facial nerve, &c.

In the second, we have only the fore part of the transverse processes of the three first cervical vertebræ, upon which lie the anterior branches of the nerves of the same name.

In the third direction, we find the posterior border of the lower jaw only; but we cannot abandon this part without making a few remarks upon the temporo-maxillary articulation.

The glenoid cavity being bounded posteriorly by the styloid and vaginal processes, and the vertebral column, does not admit of luxations of the condyle in this direction. Internally the spinous process of the sphenoid bone prevents its displacement on this side, and for the same reason opposes the luxation outwards,

since one of the condyles cannot be thrown outwards without the other being driven inwards; therefore, it is forwards only that the maxillary bone can be dislocated, because the condyle, when the jaw is depressed, always tends to the slide upon the transverse root of the zygomatic process (*eminentia articularis*). Furthermore, it is impossible for this accident to occur during infancy, as the acute angle at which the os maxillare inferius and os temporis are then articulated presents an insuperable obstacle to it.

As this articulation is only separated from the skin, externally, by a simple ligament, wounds inflicted upon this side may very readily open it.

The reddish cellular tissue, which fills the glenoid cavity posteriorly, forms an elastic mass of greater or less thickness, which separates the condyle from the auditory canal, but permits them to approximate very much when the jaw is greatly depressed. It is this tissue which shuts in part the fissure of Glaser, and prevents a direct communication between the articulation and the tympanum. It is on the inner side of this chink, and without the cavity of the joint that we find the corda tympani; it is also on the inner side of the condyle that the auricular nerve is seen coming from the inferior maxillary, and passing towards the temple where it forms the superficial temporal; whence the possible alteration of this large branch in diseases of the articulation.

Section 2. Nasal Region.

It is bounded superiorly by the frontal; inferiorly by the labial; and on each side by the orbital and zygomato-maxillary regions.

CONSTITUENT PARTS.

1. The Skin.

This membrane is pretty thick between the eye-brows and upon the root of the nose; in the rest of the region it is thin, and of but little extensibility. In the first situation it is sometimes covered with hairs; upon the nose, never. It contains a great number of sebaceous follicles; for which reason this part of the

face is speedily covered with a greasy exudation. The secretion from these follicles is profuse, especially in the skin of the lobule, and in the lateral furrow of the nose, and in certain subjects it may be squeezed out from the cryptæ in the form of small filaments. When this animal oil becomes still more concrete it remains in the follicles and frequently forms *tumes* (*acne punctata*) which seldom acquire any considerable volume.

II. *The Cellular Layer.*

Upon the body of the nose it is thin, dense, compact and destitute of adipose vesicles; but at its root it is thicker, more lax, and encloses very minute adipose cells. It is on account of its compact texture, in the first instance, that tumours occurring in this layer are small, flattened and circumscribed, that abscesses rarely form in it, and that its inflammations generally assume the erysipelatous character; whilst at its root, the opposite phenomena may occur. On the other hand, however, we may remark, that the increased thickness of all these organs, at this point, is of much utility, when we wish to form an artificial nose at the expense of the skin of the forehead.

III. *The Muscles.*

These are, in the middle and superiorly, the *pyramidalis nasi*; transversely and laterally, the *compressor narium* (*transversalis vel triangularis nasi*), crossed by the *levator communis*. The *depressor alæ nasi* also appertains to this region, but it may well be classed with those of the labial region. The first three seem to be confounded in the nasal aponeurosis, and are of no importance in surgery; it is only necessary to recollect the direction of their fibres, that we may avoid, in the performance of operations, cutting across them.

IV. *The Arteries.*

They are large and numerous, in proportion to the size of the organ. At the root of the nose we observe the nasal branch of the ophthalmic, which anastomoses with the facial; upon the dor-

sum, the branches which originate from the latter, which also sends some twigs to the septum and alæ; some small branches from the coronary and infra-orbital; lastly, in the lobule we find the ethmoidal coming from the interior of the nose.

It is on account of this free supply of blood that, when cerebral congestions and other affections of the head exist, the nose is habitually red in some individuals.

This same disposition also accounts for the success attendant upon the making of new noses, whether according to the Indian method, or that of *Tagliacozzi*.

v. *The Veins.*

Almost all of them pass into the angularis, which also receives the frontal veins; whence we may account for the success which the ancients derived from bleeding at this point in certain affections of the nose and cranium. Their capillaries are numerous; but as they are imbedded in the subcutaneous layer, which is dense, the circulation through them is not very free. To this cause, perhaps, instead of arterial action, we may attribute the red colour of the nose in some persons.

vi *The Lymphatics.*

They follow the track of the arteries, and generally enter the glands beneath the jaw; whence tumefaction of the latter in some affections of the nose.

vii. *The Nerves.*

They come from the ophthalmic of Willis and the superior maxillary nerve, and are, superiorly, a filament of termination from the internal nasal, and another twig from the external nasal branch of the frontal; upon the sides numerous branches from the infra-orbital; upon the dorsum and in the lobule, the ethmoidal filament of the nasal branch of the ophthalmic which has traversed the nostrils.

These nervous supplies sufficiently account for the acute sensibility of the nose; the sympathetic affections which its inflamma-

tions may produce, and the violent pains which frequently accompany the latter. These phenomena are also aggravated by the compact structure of its tissues.

VIII. *The Bones and Cartilages.*

The first are the whole of the nasal bones, and almost the whole of the nasal process of the superior maxillary bone. The relations of this nasal process with the lachrymal passages, its articulation with the os frontis and ossa nasi, the disposition of the latter in relation to the cranium and nasal fossæ, readily account for the cerebral disturbances, affections of the orbit, of the lachrymal sac, &c., produced by the fractures, exostoses or other diseases of the bones appertaining to the nasal eminence. These bones being somewhat thick and very short, cannot be fractured but by a direct cause, and the force necessary to produce this accident renders the wound more severe by the injury done to the soft parts than by the fracture itself. As they are not supported in the nasal fossa, they are readily displaced; and, if we do not take the necessary precautions, a disagreeable deformity, impeded respiration, alteration in the voice and in the sense of smell will ensue. They also differ in length, thickness and degree of elevation which renders them more or less liable to fractures, and produces the varieties in the form of the nose.

The second are the triangular cartilages, those of the circumference of the nostrils, and of the alæ; then the anterior margin of the septum. The latter is encased between the others in such a manner that it would be possible to extract a part of it, if it was diseased, without penetrating into the nasal fossæ. In order to do this it would be sufficient to incise the lobule and septum upon the median line, and then detach the internal branch of each cartilage of the alæ. It is at the place where these last unite with the lateral cartilage that we observe the most remarkable depression which exists upon the nose. A filament of the *nasalis internus* (*naso-lobaire*) nerve passes between the inferior border of the os nasi and the triangular cartilage. If this nerve was the seat of neuralgia, it would not be difficult to discover and divide it. All these elastic laminæ are covered by a very dense

fibrous perichondrium, which unites them to the surrounding parts and is continued upon the bones forming their periosteum.

Syphilitic affections, cancerous warts, &c. sometimes render it necessary to amputate the free extremity of the nose. The preceding anatomical remarks show us that this amputation may be performed as far as the place where the bones unite with the cartilages. It is on account of this amputation, or the loss of the lobule by accident or disease, that the formation of a new nose (*Rynoplastique*) has been recommended, whether for the purpose of correcting a hideous deformity, or for restoring the sense of smell, which, according the experiments of M. Magendie, is lost when the extremity of the nose has been removed. Professor Bécclard has remarked, that a metallic artificial nose equally re-established the olfactive function.

The nose is one of the parts of the face which has the greatest influence over the expression of the physiognomy; it is also a powerful index of disease; but as this more properly belongs to semiology, we will not deviate from our subject to enter into details of these peculiarities.

The following is the order of super-position in this region: 1st, the skin; 2d, the fibro-cellular layer; 3d, the muscles and aponeurosis; the vessels and nerves are distributed among these different tissues; 4th, the periosteum and perichondrium: 5th, the bones and cartilages.

Sect. 3. Orbital Region.

This region comprehends the whole of the apparatus of vision, and the greater part of the lachrymal apparatus. It is bounded by the circumference of the orbit, and consequently has the nasal region internally, the temporal externally, the frontal superiorly, and the zygomato-maxillary inferiorly. It presents for our consideration the orbital arches, the eyelids, the palpebral angles, the eye, and the orbit.

1. The Supra-orbital, or Superciliary Arcade.

The skin which enters into the composition of this arcade is

thicker than that of the eyelids, and thinner than that of the forehead; it is supple, extensible, and gives insertion to the hairs of the eyebrow. These hairs are generally darker than those of the scalp; they serve to diminish the intensity of the rays of light which pass to the eye, and to direct the course of the sweat towards the root of the nose. This remark enables us to comprehend why their falling out, or destruction, so frequently induces inveterate ophthalmia or other diseases of the eye.

The volume of the eyebrow depends upon several causes: in the first place, upon the size and number of the hairs; next, upon the thickness of the soft parts on which they rest, and especially upon the prominence of the osseous arch. We will refer to this when we come to treat of each of these parts separately. There are a great number of follicles between the roots of the hairs especially towards the nose.

The subcutaneous cellular tissue forms a dense, thick, and filamentous layer, in which we meet with adipose vesicles. This layer presents nearly the same characters as that which lines the hairy scalp; the same surgical considerations, therefore, are applicable to it.

The muscles are, the superior arches of the orbicularis palpebrarum, which follows the same direction as the arcade; the inferior portion of the frontalis which descends perpendicularly behind the preceding; internally, a part of the pyramidalis, and lastly, the corrugator supercilli. This last, the most important of all, passes obliquely upwards and outwards from the internal orbital process, between the frontalis and orbicularis palpebrarum, in order to terminate in the skin.

These muscles are not in relation with any aponeurosis; the cellular tissue which separates them is loose and lamellated; whence it follows that abscesses may form here, and that in consequence of wounds, of whatsoever nature they may be, the pus burrows between these organs and the bones: therefore, if suppuration is imminent, we should not reunite them immediately, and when the matter has formed evacuate it immediately.

The arteries of the superciliary arcade are not proper to it, for the most part, they only traverse it. They are: externally, some twigs from the anterior temporal branch; at the inner third-

some small branches from the supra-orbital, the trunk of which ascends between the frontalis and corrugator muscles; internally, ramosculi from the nasal.

Consequently, a wound inflicted about one inch above and external to the tendon of the orbicularis, may occasion a troublesome hæmorrhage. In such a case, if the artery is divided between the muscles, it may be easily tied, because the cellular tissue here is lamellated, and of slight density. Above the corrugator, on the contrary, it would be better to compress it, because it would be difficult to pinch up the vessel in the subcutaneous layer.

The superficial veins require no particular notice here; the others follow the course of the arteries; the frontal, however, should be attended to, which descends along the median line between the two orbital arcades. We have already seen this vein in the frontal region, and will soon find it again in the great angle.

It is proper to note that the lymphatic vessels do not all enter the same glands. The most internal, like those of the forehead, follow the blood vessels of the face, and run into the submaxillary lymphatic glands; whilst those of the external portion direct their course towards the fore part of the ear. This disposition leads us to believe that diseases of the head of the eyebrow, will affect the glands beneath the jaw; and those of its external half, the absorbent glands of the parotideal region.

The nerves are the most important parts which we have to consider here. Externally, we find one or more filaments of the facial, which come to anastomose with the supra-orbital; quite internally, some twigs from the nasalis internus, which inosculate with the frontalis; but the largest are the two cords of the supra-orbital, which sometimes come out of the orbit together through the supra-orbital foramen; more frequently, however, the small branch passes between the cartilaginous pulley of the trochlearis, and the internal orbitary process. These nerves appear to be the seat of those acute pains known by the name of frontal neuralgia; and it is for this reason that the superciliary nerve is frequently divided for the purpose of removing these pains. By this means, these pains have been sometimes suspended, but as they have occasionally returned, their re-appearance has been

attributed to the anastomosis of the divided branch with those in its vicinity. Notwithstanding this explanation may appear satisfactory, it is not certain that it is correct, because in these cases, the two divided extremities of the nerve may have become reunited, and the nervous influence thereby transmitted along the same cord. Therefore, if this operation is decided on, we should not content ourselves with a simple division of the diseased nerve, but likewise remove a portion of it. Furthermore, in order to reach it easily, we must seek for it immediately as it comes out from the supra-orbital notch, because, in this situation, we would have to divide only the skin, the orbicularis muscle, and two thin layers of cellular tissue. In order to find this notch, we have only to carry the finger along the border of the osseous arch from its internal towards its external extremity, and the first depression we meet with, will be that which includes the nerve. It is generally situated about one inch external to and above the direct tendon of the orbicularis palpebrarum. During the operation, we must keep the eye-brow firmly elevated; for its muscle, in contracting, would draw it down, and thereby interfere with the free play of the instrument.

The skeleton of this arcade appertains entirely to the os frontis. Its external half generally forms a thin edge: its internal is more rounded, and it is upon this that the head of the eye-brow rests: it is more or less prominent, on account of the frontal sinus which corresponds to it.

External violence acting upon this arch, is much less liable to occasion its fracture than that of the vault of the orbit which is much thinner. As the eye-brow is frequently the seat of encysted tumours (*loupes*), in which hairs are sometimes observed, certain authors have supposed that the presence of the latter is merely owing to a simple deviation from their natural direction (Béclard); others, to an unnatural elongation of the small root of those of the eye-brow; whereas M. Laennec says that they are accidental productions.

11. *The Superior Palpebra.*

This eye-lid is continuous, superiorly, with the eye-brow; is longer, broader, and more curved than the inferior, and the skin

which enters into its composition is very delicate and very extensible. The layer of lamellated tissue is very lax, and never contains fat; it encloses a fibrous plate, the external half of which is sometimes very strong: this is the palpebral ligament. This ligament is attached to the external half of the circumference of the orbit, and internally is converted into a cellular structure of greater or less density.

The aponeurotic expansion of the levator palpebræ superioris muscle, the tarsal cartilage, the *meibomian* glands and conjunctiva also enter into the composition of the upper eye-lid; upon the free border of which we observe, in the four external fifths, anteriorly the cilia; posteriorly, the orifice of the palpebral follicles; at the union of this portion with the internal fifth, the punctum lachrymale, then its canal; finally, between the conjunctiva and the internal surface of the tarsal cartilage, near the convex margin of the latter, the opening of the ducts of the lachrymal gland.

III. *The Inferior Palpebra.*

This is shorter and narrower than the preceding, and is continuous with the inferior orbital arcade. Its constituent parts, like those of the superior, are the skin, which is equally delicate; a lamellated layer, in which a few adipose vesicles are sometimes developed; the inferior half of the palpebral ligament; very rarely a depressor muscle; the tarsal cartilage; some fine cellular tissue, and the conjunctiva. The free border, less concave than that of the superior, does not otherwise differ from it.

Each element of these membranous veils possesses some peculiarity which it is proper to point out.

A. *The Skin.*

It is extremely thin, soft and vascular, which causes it to assume a bluish or livid appearance in certain indispositions; it is never covered with hairs; in old people, it is wrinkled in arcs of circles, and, in all subjects, it is but loosely united to the subjacent laminated tissue. It is owing to this looseness of texture that the cutaneous tissue of the eye-lids sometimes elongates sufficiently to admit of the inversion of the eye-lids, thereby produc-

ing ophthalmia, which cannot be cured but by removing a certain portion of the skin thus relaxed.

B. *The Laminated Tissue.*

This element never contains fat, from which circumstance the eye-lids appear depressed in those who are corpulent. Its lamellæ are very loosely arranged, whence serous infiltrations frequently and speedily form in this tissue. It is also owing to the same circumstance that such extensive ecchymoses occur here after the application of leeches ; therefore it would be better, in many cases, to apply them to the conjunctiva itself, which we have frequently done with success.*

The cellular tissue which unites the orbicularis palpebrarum muscle to the ligament of the eye lids, the tarsal cartilage or to the conjunctiva, although lamellated, is more dense and does not admit of infiltrations. It is between the laminæ of this cellular tissue that encysted tumours of the eye-lids are developed ; consequently, as these tumours are nearer to the conjunctiva, than the skin, it is better to expose them upon the inner surface of the palpebra.

C. *The Muscles.*

We only find in the inferior eye-lid the corresponding arches of the orbicularis, whereas the superior has in addition its levator muscle ; whence the great mobility of the latter, whilst the former is scarcely susceptible of any movement. The fibres of the orbicularis are paler, thinner and less curved, the nearer we approximate the edge of the palpebra. Their insertion will be examined when we come to speak of the great angle.

D. *The Palpebral Ligament.*

It is attached to the external half of the two orbital arches, and is situated between the orbicularis muscle and conjunctiva ; it seems to be continuous with the external extremity of the tarsal

* Nouveau Journal, etc. 1821.

cartilages. Its existence on the outer side of the orbit renders inflammations there more painful, on account of the resistance which it opposes to the tumefaction of the parts, and it also represses, for a length of time, the external projection of tumours which form between it and the conjunctiva, or in the cavity of the orbit.

E. *The Tarsal Cartilages.*

The tarsal cartilages are much thinner at their convex border than towards the palpebral aperture. In the first direction they are connected to the ligament of the eye-lids, and, besides, in the superior lid, to the levator muscle; in the second, they are enveloped only by the skin and the mucous membrane to which they are very intimately united: from which circumstance the slight inflammations which originate here are very painful and produce the stye.

The tarsal cartilage is covered by the orbicularis muscle, and rests upon the conjunctiva, from which it is separated by the glands of Meibomius only. That of the upper lid is also in relation with the ducts of the lachrymal gland; its breadth from above downwards, is five lines; its length, transversely, from five to six lines; the inferior is also six lines transversely, but only two lines from above downwards. Their posterior surface is concave, and moulded upon the convexity of the eye; finally, these plates form, properly speaking, the skeleton of the eye-lids.

F. *The Conjunctiva.*

This membrane is dense, very firmly adherent to the free margin, and about as much as a line upon the internal surfaces of the palpebræ; it then becomes soft and supple, in proportion as it approximates its point of reflexion upon the globe; it is supposed to dip into the orifices of the ducts of the lachrymal gland, which form an arch towards the point corresponding to the convex margin of the tarsal cartilages. As this membrane becomes much less adherent in approximating the eye, than it is near the free margin of the palpebral veils, it is much better, when we wish to make the excision for the cure of ectropium, to cut at a little distance from, rather than too near, this margin.

G. *The Palpebral Follicles or Glands of Meibomius*

These small granulations are collected in perpendicular lines upon the grooves which the ocular surface of the tarsal cartilage presents; they all open upon the posterior crest of the free margin of the palpebræ. Perhaps the conjunctiva penetrates into their orifices. It is in the ophthalmia depending upon the affection of these small organs that the dessicative ointments of Desault, Regent, etc., seem to have proved beneficial. For this purpose the unguent should be applied over the entire border of the palpebra, and not simply introduced at one of the angles.

H. *The Arteries.*

Internally we find the two internal palpebral arteries, furnished by the ophthalmic; externally, the two external palpebral, derived from the lachrymal; superiorly, some twigs from the supra-orbital, and inferiorly, some ramusculi from the infra-orbital and facial arteries.

The first four form two arcades which have the same direction with the curvature of the eye-lids, and are situated four or five lines distant from the free border, behind the orbicularis muscle. These arches resemble the coronary arteries of the lips, and we should pay attention to their volume and situation in all operations in which the eye lids are concerned. They are sufficiently remote from the margin of these veils to permit us to remove a considerable portion of them, in cancerous or other diseases, by following the advice given by MM. Dubois, Richerand, and Dupuytren, without wounding the vessels. On the contrary, if according to the ancient method, we are obliged to include the morbid tumour in a triangle of sound tissue, resembling the form of a V reversed, these arteries will necessarily be divided.

J. *The Veins.*

Almost all of them pass to the ophthalmic, a few only into the angular vein; they are larger than the arteries, and communicate directly with those of the brain: from this communication we

may in part account for the pain, redness, and inflammation of the eyes which we so frequently observe in diseases of the encephalon.

K. *The Lymphatics.*

Those of the external portion of the superior palpebra pass to the parotideal region, all the others cross the face, directing their course below the jaw.

L. *The Nerves.*

We find, internally, and parallel to the direction of the arteries, the palpebral branches of the *nasalis internus*; externally, filaments from the lachrymal and a few from the facial; superiorly it is also supplied by the two branches of the frontal, and the inferior palpebra receives some from the infra-orbital nerve.

It is to this free supply of nerves that the eye-lids owe their exquisite sensibility; a sensibility which is also increased, towards the free margin, by the compact texture of the tissues. This last peculiarity seems to us to explain the reason why the application of leeches to the conjunctiva is very painful, when made too near the palpebral border, whilst they are scarcely felt when applied at a greater distance from it.

M. *The Cilia.*

These are the hairs implanted into the anterior crest of the free margin of the eye-lids; they are continued only as far as the *punctum lachrymale*, and, when the eyes are open, form a curve, the concavity of which looks towards the orbital arches. They are arranged in two or three rows, and may deviate, in such a manner, as to pass towards the eye instead of taking the opposite direction. Their roots are surrounded by follicles, which, when diseased frequently cause the eye-lashes to fall out. Their bulbs receive numerous filaments from the palpebral nerves, which may, in general, be easily traced to the piliferous ampullæ.

N. *The Infra-Orbital Arch.*

It is with this that the inferior eye-lid is continuous ; it presents successively from the surface towards the deep-seated parts, 1st. the skin already stronger and less extensible ; 2d. a cellulo-adipose layer of more or less thickness ; 3d. a portion of the orbicularis muscle ; 4th. a second cellular layer, containing adipose vesicles ; 5th. the periosteum ; 6th. the bones, upon which we observe the zygomato-maxillary suture. These bones being thick and compact they are seldom fractured ; but the arch which they form is of great assistance, in certain cases, in finding the lachrymal groove. We will resume this subject when we come to speak of the great angle.

O. *Of the Temporal Angle of the Palpebræ.*

Through the skin, in this situation, we feel a pretty deep depression, which is limited, superiorly, by the external orbital process of the os frontis ; inferiorly by the frontal angle of the os malæ. The palpebral commissure is, in general, two or three lines on the inner side of these bones, and the eye appears to be larger or smaller in proportion to the distance of this commissure from them, which is then owing to the slit in the eye-lids being more or less extensive.

As the margins of the palpebræ touch each other towards their external extremities even when half open, if we are not particular in separating them frequently, when inflamed or excoriated, unnatural adhesions will form between them.

In this angle, we find, 1st. the skin and the lax cellular tissue common to the palpebræ ; 2d. the external extremity of the fibres of the orbicularis, and the raphe which results from their intersection ; 3d. the strongest portion of the palpebral ligament ; 4th. the conjunctiva ; 5th. the origin of the two external palpebral arteries ; 6th. the termination of the lachrymal nerve ; 7th. some filaments from the facial, and 8th. the zygomato-frontal (*external transverse*) suture.

In some persons, and especially the aged, the skin of the temporal angle presents many convergent folds, which should be

attended to when we make incisions into this part. Exclusive of these wrinkles, we may incise in all directions without danger, since the muscle has no fixed point on this side and there are no important nerves or vessels to be avoided. However, it should be remarked that the conjunctiva is somewhat removed from the palpebral ligament, for it might happen that wounds, penetrating into this space, may be rendered dangerous from the facility with which inflammation and pus penetrate into the cavity of the orbit.

P. *The Great Angle.*

This angle is one of the most important parts of the orbital region, both on account of the frequency of its diseases and of the operations here performed.

This part, connecting the eye-lids to the nose, is covered by a skin which partakes of the characters of both of these regions. It is much less extensible than upon the eye-lids, but thinner than upon the nose: on account of its tenuity, abscesses which form beneath soon perforate it, and tumours which raise it seldom become of large size without disorganizing it.

Beneath the skin is the common cellular layer.

Next comes the orbicularis palpebrarum muscle, which here deserves great attention. Inferiorly, its fibres are attached to the external surface of the ascending process of the superior maxillary bone, where they cover a small portion of the levator labii superioris aequæ nasi. Superiorly, some of these fibres are fixed to the internal orbital process of the os frontis, and in the middle they originate from a tendon which requires particular examination.

This tendon is about one line in breadth and three in length, is flattened and attached to the external labium of the lachrymal groove; it bifurcates in terminating in the eye-lids in order to become continuous with the tarsal cartilages, and rests upon the fibrous portion of the lachrymal sac, in the formation of which it seems to concur. We designate the tendinous portion, properly so called, the direct tendon, and the fibres which it furnishes to the sac, or which it receives from it, the reflected tendon. The

transverse position of the direct tendon divides the sac, as it were, into a superior and an inferior portion.

The inferior is seen in a triangular space with an external base, the superior side of which is straight and formed by the tendon. The inferior side of this triangle is concave and formed by the external labium of the lachrymal groove, and the anterior border of the superior maxillary bone. It is in the summit of this space that we must introduce the point of the bistoury in order to penetrate easily into the lachrymal sac.

The direct tendon receives the fleshy fibres of the two palpebræ, and serves as their fixed point upon the nose; consequently, if we divided this fibrous bandelet, ectropium would follow, as was the case in the operation for fistula lachrymalis, recommended by Wolhouse.

We will speak of the superior portion when considering the lachrymal passages.

Q. *The Puncta and Lachrymal Canals.*

These organs are situated in the rounded and straight portion of the free margin of the palpebræ. The puncta, or external orifices of the ducts consist of a small fibro-cartilaginous ring, and are situated at the internal extremity of the posterior crest of the concave portion of the free border: they dip perpendicularly into the eye-lid, to the depth of about a line, and afterwards form a rectangular turn and become continuous with the canals.

When the lids are open, these orifices look obliquely between the globe of the eye and the caruncula lachrymalis; when closed, they look directly backwards. On account of this disposition, therefore, when we wish to introduce an instrument into them, we must evert the lid, and then it will fall perpendicularly into the aperture. The canals then pass towards the commissure, following exactly the direction of the straight portion of the palpebral border. They sometimes unite before they enter the lachrymal sac, into which they then terminate by a common opening; and again they only approximate each other and open separately into it.

The lachrymal canal is situated in the posterior part of the margin of the palpebra; therefore, it is less exposed to the action

of foreign bodies: it is separated from the eye and the caruncle by the tunica conjunctiva only, and appears to be merely a prolongation of the mucous membrane of the nose. From this it follows that its ocular paries is very thin and soft, so that it is liable to be perforated by the stylet, in the operations proposed by Anel, Mejan, etc., if we do not pass it in the proper direction.

The superior canal being more easily placed in a direction parallel to the nasal duct by raising the palpebra towards the head of the eye-brow, it should be preferred for the purpose of introducing probes, setons, or other foreign bodies into the lachrymal passages. It is by the inferior, on the contrary, that we should throw in our injections, on account of its transverse position and greater degree of immobility, on the one hand, and, on the other, because we can easily obtain a point of support upon the os malæ.

R. *The Lachrymal Sac.*

This sac seems to form the superior half or termination of a canal which comes from the nose. It is crossed anteriorly, as we have already observed, by the direct tendon of the orbicularis, above which it terminates in a *cul-de-sac*, and is formed by a cellulo-fibrous canal, four lines in length and from two to three lines in breadth. Internally, it lies upon the lachrymal groove, where it becomes blended with the periosteum, and to which it is firmly adherent; externally, it is separated from the caruncle and conjunctiva by a fibrous expansion, which is fixed, on the one hand, to the posterior margin of this gutter, and on the other, to the posterior surface of the direct tendon of the orbicularis muscle, from which it originates, and of which it constitutes the reflected tendon. This expansion is only found opposite to and above the direct tendon, which explains in part why the lachrymal tumour is more fully developed below this fibrous bandelet, in the triangle which we there observe. Anteriorly, the sac is covered by the origin of the fibres of the orbicularis, and a few fibrous lamellæ which are continuous with the periostium of the root of the nose. Its internal surface is lined by a mucous membrane, which is usually a little redder than that of the lachrymal canals.

As this sac is adherent by its external surface to solid and immoveable parts, its relations are consequently fixed and unchangeable; that is to say, it is incapable of active alternate dilatation and contraction in its natural state. This circumstance shows us the futility of the advice given by *Monro*, to introduce a sound into the lachrymal sac through the nasal duct, for the purpose of stretching the anterior paries of the former, whilst cutting into it in the operation for *Fistula* by the method of *J. L. Petit*. It is also on account of this intimate adhesion of the sac to the osseous groove, that we are induced to give the following directions for penetrating its cavity: We should direct the point of the bistoury obliquely downwards, inwards, and backwards, below the direct tendon, and then in proportion as we plunge it deeper, gradually elevate the handle of the instrument towards the head of the eye-brow. In this manner we will be sure to enter into the sac, and to incise it to a great extent, without making but a small opening in the skin. In fact, the point of the instrument having entered the sac very high up, it follows that, in passing it onwards, we will continue to cut its external paries, which is longer than the internal, and that we will run no other risks than that of penetrating uselessly to the bone, by traversing the mucous and fibrous laminæ of the internal paries of the sac: but, on the one hand, the compact union of these parts will prevent their being separated, and, on the other, the instrument will soon enter the sac by the swinging motion which we make it execute; so that the worst which can happen will be reduced to a simple incision of these membranes in a point which we are recommended to avoid; an incision which cannot be more serious than the external, since the parts divided are of the same nature.

The Nasal Duct is the continuation of the preceding: lined by the same mucous membrane, it adheres to the osseous canal throughout its whole extent, which makes it almost an inert passage in relation to the operations which its diseases call for; from whence arises the success obtained from the use of the metallic canula, so highly recommended by *Pellier*, *Foubert*, *Wathen*, *B. Bell*, *Dupuytren*, *Taddei*, etc.

This duct is from five to seven lines in length: it is a little broader than the lachrymal sac, and its antero-posterior diameter

is a little greater than its transverse. United to this sac, and considered as extending downwards from the tendon of the orbicularis, it presents a slight curvature with an external and anterior convexity. The lachrymal portion alone, on the contrary, is slightly convex inwards and backwards. It is important to be well acquainted with this disposition, whenever we wish to pass instruments, etc., from the puncta lachrymalia to the nose, or to place foreign bodies in it. We will take up the consideration of the inferior orifice of the nasal duct, when we come to the nasal fossæ.

The bones which inclose the nasal canal also merit some attention. Thus the lachrymal gutter is hollowed out, anteriorly, in the posterior border of the ascending process of the os maxillare; posteriorly, in the external surface of the os unguis: therefore, when we wish to make an artificial course for the tears, according to the method of Wolhouse or that of Scarpa, it is better to perforate the bones in the latter direction than in the former, because the os unguis is much thinner than the nasal process. In this situation these bones correspond to the middle meatus (*of the nasal fossa*). The nasal canal is formed, anteriorly, by the prolongation of the lachrymal gutter of the ascending process, and on this side, does not correspond to any important organ; posteriorly, by the inferior portion of the os unguis and its curved crest, by some lamellæ of the superior maxillary and a small portion of the inferior turbinated bone. This wall is thin and very brittle, so that nothing would be more easy, in operating for fistula lachrymalis, etc. than to penetrate into the nasal fossæ or maxillary sinus, if the instrument is directed too far backwards. The internal wall of this canal is formed by the prolongation of the os unguis, and the curved portion of the inferior turbinated bone. It is not more solid than the preceding, and as it corresponds directly to the nostril, it may be depressed by polypi or other tumours which are developed in the nose: whence *epiphora*, *fistula lachrymalis*, etc.; finally, its external wall is constituted by the lamina which borders the maxillary sinus, and sometimes a small process of the inferior maxillary bone which is joined with it. It is as thin as any of the others, and very much exposed to fractures, or perforations, in probing the canal as recommended by Laforest. We then penetrate the

maxillary sinus. For the same reason, tumours of this last cavity seldom acquire a certain volume without impeding and even preventing the descent of the tears into the inferior meatus (of the nasal fossæ).

Between the lachrymal sac and the globe of the eye, on the one part, the palpebral commissure and the puncta lachrymalia, on the other, we find the *caruncula lachrymalis*. This small organ is pale when serous effusions exist in the large cavities of the body, and of a more or less reddish white in the normal state. It is formed by a fold of the conjunctiva, in which a considerable number of agglomerated follicles, hairs and even a small cartilage are found. To these may be added the *lachrymal muscle*, which is situated behind the sac and canals of the same name, to which it adheres, and which it may compress and even draw towards the os unguis, which is its fixed point. These uses, recently attributed to this small muscle by Horner and Gery, appear to be real, notwithstanding Trasmondi has affirmed the contrary. They enable us to understand how a spasmodic contraction may take place in the lachrymal organs in one point, whilst it does not appear possible for this phenomenon to manifest itself in the nasal canal, properly so called. Furthermore, the *caruncula lachrymalis* actually possesses all the elements of a complete eyelid, and thus presents us with the rudiment of the *membrana nictitans* of birds, &c.

It is by the internal extremity of the groove which separates the caruncle from the inferior eyelid, that Pouteau advised penetrating into the lachrymal sac; and more recently it has been proposed to penetrate it by commencing the incision in the groove which separates this caruncle from the superior palpebra, in order to incise it to a much greater extent: in the latter case, however, the muscle of Horner would be cut across, and if it is true, that its action is useful for the excretion of the tears, we conceive that considerable inconvenience would result from it.

S. *The Orbital Portion properly so called.*

The globe of the eye occupies the centre of it, and is more nearly approximated to the anterior than the posterior plane. The form of this organ is that of a spheroid slightly flattened

upon four surfaces. Its antero-posterior diameter is about ten or twelve lines; in the other directions it presents a line less.

It is from these dimensions of the interior of the eye that Hey advises a needle of only seven or eight lines long for the depression of the crystalline, and for the same reason Græfe has added a species of shoulder to the shaft of his, for the operation of *Keratonyxis*.

The eye is divided into two chambers, the anterior and posterior. The anterior is bounded by the iris behind and by the cornea before; its transverse diameter is from four to five lines, its perpendicular diameter a little (*quelques millimètres*) less. From the pupil to the centre of the cornea the distance is about two lines. This space then gradually diminishes in proportion as we approximate the great circumference of the iris, where this membrane touches the cornea; from which circumstance, when we perform the *keratonyxis*, the concavity of the needle must look forwards, whilst we penetrate into the anterior chamber. In fact, if the point of this instrument was directed backwards, or if we made use of straight needles, like those of Beers, Schmidt, Himly, &c., it would be difficult to arrive at the pupil without wounding the iris.

The transparent cornea, which entirely belongs to this chamber, forms nearly the anterior fifth part of the eye; its circumference is, as it were, cased in the anterior aperture of the sclerotica, and as it is the segment of a smaller circle than the rest of the organ, it forms a kind of superficial furrow upon the external surface of the membranes, near the point where this surface corresponds to the iris. This groove prevents us from inclining the handle of the knife so much forwards, in the extraction of the cataract, as the perpendicular of the eye would seem to require.

This membrane is composed of six slightly extensible and brittle laminæ, separated by an albuminous fluid, which, on concreting, during inflammations of the eye, produces opacity of the cornea. It is between these laminæ that the *ceratotome* slides, in traversing the cornea, in order to enter the anterior chamber, when the surgeon does not follow exactly the perpendicular of the furrow mentioned above. Anteriorly, it is covered by a lamella which seems to appertain to the conjunctiva, but which only assumes the characters of mucous membranes in certain

diseases. This lamella is so intimately adherent to the horny tissue, that it is scarcely possible to separate them by dissection : which has led several anatomists* to suppose that its nature was different from that of the conjunctiva. Be this as it may, it is between it and the transparent membrane of the eye that the serosity accumulates which constitutes the ptyctenæ of the cornea.

Posteriorly, it is lined by the membrane of the aqueous humour, a species of lamina which does not appear to cover the fore part of the iris, notwithstanding several very correct observers say that it does so. The anterior chamber is filled with a liquid which is reproduced with great facility, in young subjects especially. It is on account of the presence of this fluid that, when the cornea is once traversed, the instrument must never be withdrawn ; because, no longer filling exactly the opening which it has made, the water will escape from the cavity which encloses it, and the eye becoming flaccid, the section must necessarily be completed with the scissars. As the transverse diameter of the cornea is the greatest, we prefer, in the operation for cataract, the incision from the temporal angle towards the nose, to the vertical incision. Wenzel and the greater proportion of French surgeons advise us to traverse the anterior chamber, not directly across, as recommended by La Faye, but very obliquely from above downwards and from without inwards, for fear that the flap might be raised by the depression of the eye, or by the movements of the lower lid. This method of operating does not appear to us to be free from censure, or, at least, is not so essential as many authors pretend. In fact, in attempting to traverse the eye in this direction, the prominence of the external orbitary process of the os frontis will sometimes throw the handle of the knife so far forwards, that it will be difficult to make its point pass out in the great angle, without wounding parts which it is of importance to avoid ; besides the anatomical disposition of the parts does not permit the flap of the cornea to be readily raised by the free border of the lower lid, and further, after the operation, the patient has his eyes closed : it is the superior palpebra which descends, and not the inferior that rises. Neither would the eye itself, when descending, favour the occurrence of this accident ; and if,

* M. Ribes.

moreover, it should happen, it is not the oblique incision which would prevent it, for the internal extremity of the flap would be equally exposed to the same eversion. In short, we think that this question requires further examination.

The posterior chamber is extremely complicated. Its walls are formed by three membranes placed one within the other, and are thus arranged: the sclerotic, external; the choroid, central; and the retina, internal.

The first is thickest posteriorly, but is strengthened anteriorly by the fibrous expansion of the muscles; it is composed of parallel fibres, which extend from the optic nerve towards the cornea; some also are circular and transverse, but these last are less numerous.

The second, or choroid is essentially formed by vessels. On its external surface, between it and the sclerotic, the ciliary nerves are observed. When it reaches the ciliary circle it curves behind the iris in order to form the uvea, and it is at the place of this curvature that it gives rise, in folding upon itself, to the ciliary processes, which are separated from the great circumference of the iris by the commissure of the choroid, upon the posterior surface of which they are supported.

The third, or retina, white, pulpy, in which the nervous matter of the optic nerve is met with, appears to be the essential organ of vision. It is situated between the choroid and the vitreous body, and is prolonged at least to the circumference of the crystalline lens. We have several times distinctly observed it, in man, extend to the iris; and in the bullock it is much more readily distinguished. Is this a natural state, or is it merely an anomaly?

These three membranes are traversed by the needle in the operation for cataract. As the fibres of the external are parallel to the axis of the eye, and as the central is composed of vessels and nerves which follow the same direction, it is necessary to introduce the needle in such a manner that one of its edges looks forwards, the other backwards, its concavity being turned downwards. By acting in this way we only separate, if I may so say, the fibres and the vessels. On the contrary, if the needle is so held that its concavity is directed backwards and its cutting edges perpendicular to the axis of the eye, it will necessarily divide the parts through which it passes, and thereby give rise to

ecchymoses between the conjunctiva and sclerotica, to extravasation of blood within the posterior chamber, or to nervous symptoms, on account of the lesion of the ciliary arteries or nerves.

The posterior chamber is filled by a globular body composed of the vitreous body and crystalline. The latter is a species of inert and transparent lens, which is always more solid at the centre than at the periphery; whence it follows that its opacity is generally eccentric. The crystalline capsule, which envelopes it, is separated from it by a space which is usually in a direct ratio to the age: this space is naturally filled by an albuminous liquid, susceptible of losing its transparency by passing into a milky or purulent state; which constitutes the cataracts thus named. The capsule itself is enveloped in a separation of the *membrana hyaloidea*, so that posteriorly it rests upon the anterior part of the vitreous humour, the tunic of which sends a lamina upon the fore part of that of the crystalline. This capsule appears to be of a horny nature; it is dense, elastic and resists the entrance of the instrument: a circumstance not to be forgotten when we attempt the depression of the cataract. Some have thought that its internal surface secretes the lens itself, and that this body may be regenerated after its depression or extraction, provided the capsule is not at the same time destroyed. Doctor Cocteau has recently presented to the Royal Academy of Medicine the result of his experiments upon dogs and rabbits, which seem to give support to this opinion. Prof. Beclard was deputed to resolve this important question, and had already extracted the crystalline from the eye of several dogs, when death snatched him away in the midst of his useful labours. If the assertion of M. Cocteau is confirmed, it will be necessary, in every operation for cataract, to extract even the minutest particles of the crystalline, unless we take care to destroy the formative organ, that is to say the capsule itself.

The vitreous body is a species of sponge with very fine and transparent meshes; it is formed by a substance similar to the aqueous humour and by a membrane, the laminae of which split and intersect each other a great many times, forming the cellules which enclose the fluid. This membrane, according to Mr. J. Cloquet, is reflected upon itself behind, in order to form the hyaloid

canal, which passes through the entire thickness of the vitreous body, conveying an artery to the crystalline capsule. On the other hand, according to Petit, the learned anatomist whom we have just cited, when the hyaloid membrane arrives near the circumference of the crystalline and its capsule it separates into two laminæ, between which laminæ the visual lens is found ; so that, if we consider the crystalline as removed, the vitreous humour would bear a resemblance to the larger end of an egg, and the vacancy which habitually exists between the membrane retracted by the albumen and the calcareous shell.

In couching, the vitreous body is always perforated, use what precautions we may ; and we think, that, far from seeking to avoid this, we should always endeavour to open it sufficiently for the purpose of imbedding the lens within it ; and in order to do this, the needle having entered the posterior chamber, one of its cutting edges should be carried backwards and downwards, below the visual axis, dividing several of the laminæ of the hyaloid in this direction, so that we may be enabled to push the opaque body into it, after having placed the instrument upon the fore part of its capsule. In this way, the elasticity of the vitreous body will not oppose the entrance of the crystalline into it, but will rather retain it in the situation in which we leave it. On the contrary, if we depress it between the membrana hyaloidea and retina, we will necessarily disorganize the latter, and that elasticity, which, in the first case, retained, will constantly tend to press it upward. We do not see what danger can follow this method, which is moreover frequently adopted without anticipating any. Our former preceptor and friend, Dr. Bretonneau, always operates in this manner, and his success establishes this precept. The method by *hyalonixis*, recently recommended by M. Bowen, and formerly detailed by Farrein to the Academy of Sciences, clearly proves that we have nothing to apprehend from the lesion of the vitreous body.

Considered posteriorly, the posterior chamber of the eye forms the bottom of this organ, and upon it the image of objects is painted. We there find the posterior opening of the hyaloid canal, and the artery or pedicle which attaches the vitreous body to the retina ; the retina itself, with its folds and its punctum flavum, which are about two lines on the outer side of the optic nerve,

that is to say, nearly in the direction of the axis of the eye ; the choroid, which is perforated for the entrance of the optic nerve ; finally, the sclerotica, which is likewise pierced by the same nerve, which furnishes it with a fibrous expansion coming from the dura mater, and which is situated about two lines on the inner side of the visual axis in man.

Anteriorly, the posterior chamber is separated from the anterior by the iris, a membrane placed vertically, with a central opening, which constitutes the pupil. This organ is of a very complicated texture, and seems to contain, according to some anatomists, a prolongation of the retina, of the choroid, of the membrane of the aqueous humour, and a cellulo-vascular lamina propria. According to others, it is essentially formed by the long ciliary arteries, which anastomose four or five times in a circular direction. Some say that it is an erectile (*spongy*) tissue ; others, a double muscle. Be this as it may, in certain subjects it bulges forwards a little, in children especially, and is thereby exposed to the knife as it crosses the anterior chamber. This is most liable to happen when the aqueous humour has escaped.

Its posterior surface, slightly concave, is black ; we call it uvea. It is separated from the capsule of the lens by an interval of half a line, which is filled by the aqueous humour. The narrowness of this space renders it at least very difficult to pass a needle before the crystalline without perforating the vitreous body ; especially, as, if we admit that the posterior chamber is bounded behind by the anterior surface of the vitreous body, the crystalline lens being removed, we would have the same disposition behind the iris as before it ; that is to say, that the hyaloid membrane, like the cornea, is at first from two to three lines distant from the pupil, but afterwards approximates so close to the great circumference of the iris, that it appears to be in direct contact with the ciliary processes. Is it not evident, then, according to this disposition which does not vary, that, in passing the instrument from the sclerotica to the pupil, whether by the ordinary method, or that of M. Bowen, we will divide the vitreous body more or less extensively ?

The great circumference of the iris being attached to the union of the cornea with the sclerotica, before the ciliary circle (*ligamentum ciliare*), and there receiving the principal vessels which

enter into its composition, it follows, that, in making an artificial pupil, according to the recommendation of Scarpa, we are in danger of lacerating the nervous ring, and of producing considerable hæmorrhage. It must be admitted, however, that it is possible to avoid these accidents.

By taking the precaution of introducing the needle at a sufficient distance from the triple union of the iris, ciliary body and cornea, there would also be an advantage in it relative to the latter membrane, which, being more remote from the retractile veil of the eye, would run less risk of being caught by the point of the instrument. We have witnessed the occurrence of this accident in a patient operated upon by one of the most celebrated surgeons in Paris.

The small circumference of the iris is, as we know, susceptible of alternate dilatation and contraction, which every body explains according to his own notion, or rather does not explain at all. It is in passing before this opening, that is to say, before the pupil, that Wenzel dips the point of his knife into the posterior chamber and divides the capsule of the crystalline, at the same time that he crosses the anterior chamber in order to form a flap of the cornea. It is also by this opening that the diverse *kystitomes* fulfil the same indication, and that we arrive at the lens in the *keratonyxis*, etc. ; to facilitate which it is useful to dilate it by means of the solution of the extract of Belladonna, or any other substance possessing analogous properties. This dilatation is also necessary in order to prevent the iris from being pricked by the instrument, especially when couching. In fact, Beclard was convinced that most of the accidents which sometimes follow the depression, are owing to the tractions of the iris, and that, according to his experience, if care was taken to avoid touching this membrane, couching would, without contradiction, be preferable to extraction. Would not this idea be in favour of those who admit of a lamina of the retina behind the iris ?

The vessels of the ocular globe are exceedingly numerous and delicate. Anteriorly, this organ receives branches from the palpebral and anterior ciliary arteries, which are distributed to the conjunctiva, and are rendered equally visible upon the cornea by inflammation ; posteriorly, it receives the arteria centralis retinae, which accompanies the optic nerve. After having given off

many ramuscles to the nervous membrane of the eye, this vessel, according to authors who call it the central artery of the crystalline, passes through the canalis hyaloidea to the posterior lamina of the membrane of the lens. We have never seen it penetrate into the lens itself. This artery should be preserved during depression, for it is probable that its laceration would be detrimental to vision. The ciliary arteries form in the eye a very complicated net-work; all of them perforate the sclerotica obliquely, principally in its posterior third portion; their numerous filaments afterwards place themselves in the choroid and run in parallel lines to the ciliary processes and uvea, with the exception, however, of the two long ciliary arteries, which run along the internal surface of the sclerotica, and do not divide until they reach the great circumference of the iris. It is in consequence of the position of these two branches upon the two extremities of the transverse diameter of the eye, that we are advised to introduce the needle below it, in the operation of couching; and it is also on account of their size and direction, that we consider it best to turn the edges of the instrument anteriorly and posteriorly, as we have previously mentioned.

The greater proportion of the veins, also, are situated in the choroid. We find, besides, between this tunic and the vitreous body, the vortices of Haller, or the *vasa vorticosa*. These vessels pass through the fibrous membrane and empty their blood into the lachrymal veins.

The nerves are derived from the ophthalmic ganglion: they are distributed in the same manner and follow the same direction as the arteries, and are lost in the ciliary circle. This ring, which has all the characters of a circular nervous ganglion, would, in this case, appertain to the great sympathetic: its figure is prismatic, and its external side rests upon the most anterior part of the internal surface of the sclerotica. Anteriorly, it separates the iris from the choroid or ciliary processes, to which it adheres posteriorly. This point of the envelope of the eye is worthy of attention. It is, in fact, with the view of avoiding the iris, that we are advised, in extracting the cataract, to penetrate the anterior chamber half a line before the sclerotica. In depression, if we introduced the needle at less than a line and a half behind it, we would inevitably wound either the great arterial circle of the

iris, the ganglion (*ciliary ligament*), or the ciliary processes. Now, if it was certain that we would not more surely avoid the retina or vitreous body by introducing the needle at this point than more posteriorly, it seems to us that it would still be preferable to approximate these parts as little as possible.

The nerves of the interior of the eye may be distributed in three orders.

The first are destined for the movements of the iris, and are derived from the nasal branch of the ophthalmic and the lachrymal only; whence it follows, that wounds inflicted upon the angles of the eye sometimes suspend the contractions of the iris without interrupting vision. Baron Larrey, with whom this idea appears to have originated, has met with several cases of this nature; and but a short time since, there was a case of the kind at the Société Philomatique; so that we have been able to convince ourselves of the correctness of the fact. The second order includes the nerve of special sensation, which does not, according to the celebrated Magendie, enjoy general sensibility, but is destined solely to receive the impression of images: it is the optic nerve. Its anatomical disposition explains to us why paralysis of the retina does not alter the state of the other parts of the eye, or necessarily induce immobility of the iris. Finally, the nerves of the third order appertain to the interior life and enter into the ganglionic system: these are the numerous ciliary filaments and ciliary circle.

The order in which the parts of the eye present themselves, in proceeding from the anterior to the posterior part of this organ, is the following: 1st, the conjunctiva, or the lamina, whatsoever it may be, which covers the cornea; 2d, the transparent cornea; 3d, the membrane of the aqueous humour; 4th, the anterior chamber, which is two lines in diameter in the direction of the ocular axis; 5th, the aqueous humour, which is regenerated with great facility; 6th, the iris, the pupil, or *membrana pupillaris* in the fœtus under seven months; 7th, the space which separates the iris from the crystalline, a space which scarcely exists in children, which does not exceed half a line in the adult, and which many consider as the posterior chamber, properly so called: it is also filled with the aqueous humour: 8th, the anterior portion of the capsule of the lens, covered by a lamina of the hyaloid: 9th.

a small space which separates the anterior surface of the crystalline from its capsule, and which is filled by the *liquor Morgagni*; 10th, the crystalline lens, softer and more spherical in children than in old people, whence it follows that *myopia* is more frequent in the former and *presbyopia* in the latter; 11th, between the posterior surface of this body and its capsule, another space, filled with a liquid similar to that which is anterior to it; 12th, the posterior lamina of the capsule of the lens, thicker and more dense than the anterior, invested posteriorly by the *membrana hyaloidea*; 13th, the vitreous body, the *canalis hyaloidea*, and the central artery of the crystalline lens; 14th, the retina formed of three laminae, according to some authors; 15th, the choroid, bifoliated according to Ruysch, etc.; 16th, the sclerotic.

In penetrating transversely into the posterior chamber of the eye, we find from without inwards, 1st. the sclerotica; 2d. the choroid; 3d. the retina; 4th. the hyaloid membrane; 5th. the vitreous body; 6th. the hyaloid canal, the central artery of the crystalline, or, more anteriorly, the lens itself and its capsule. With respect to the anterior chamber, 1st. the conjunctiva; 2d. the cornea; 3d. the membrane of the aqueous humour; 4th. the aqueous humour; then the same parts on the other side of the axis.

The parts which surround the ocular globe within the orbit are,

1st. The *muscles*, which are, in the first place, the four recti, the fibrous expansion of which terminates upon that portion of the sclerotica which is covered by the conjunctiva, constituting what is called the white of the eye. Departing from thence, these muscles converge so as to form a cone, the apex of which surrounds the optic nerve, and is attached to the bottom of the orbit. From this disposition, when these muscles contract together, they tend to flatten the eye in four opposite directions, and also to draw it backwards.

Next the *levator palpebræ superioris*, which is situated between the rectus superior and the periosteum; in thin persons, or those who have a prominent eye-brow, it is this muscle which draws the eye-lid backwards, and makes it appear depressed.

The great oblique (*trochlearis*) is situated between the rectus internus, rectus superior, levator and periosteum, as far as its reflected pulley, three lines within the supra-orbital notch, and then passes behind the conjunctiva, between the levator, rec-

tus superior and rectus externus, to be inserted into the sclerotic, three lines anterior to the optic nerve. It is necessary to remark that the superficial situation of this muscle, at its point of reflexion, exposes it to wounds of different species: for example, it might be divided when attempting to divide the supra-orbital nerve, if we endeavoured at the same time to cut the internal frontal branch. Such an accident would be attended with loss of rotation inwards.

The small (*external*) oblique is attached to the floor of the orbit quite near its circumference, two lines on the outer side of the superior orifice of the nasal canal. From this point it passes behind the conjunctiva obliquely upwards, backwards and outwards, between the periosteum, the rectus inferior and rectus externus, upon the sclerotic. In consequence of its slender size at its origin, and its situation, it is liable to be divided in the operation for fistula lachrymalis, especially if the knife should slip outside of the sac: such an occurrence would destroy rotation outwards.

The direction of these last two muscles is such that, when they act conjointly, they are antagonists to the recti muscles, drawing the eye forwards.

2nd. The *nerves*, which are, in the centre, the optic nerve, enveloped posteriorly by the origin of the recti muscles, from the bellies of which it is separated by a considerable quantity of fat, which prevents its compression: around it, the superior and inferior ciliary nerves coming from the ophthalmic ganglion, resting upon the external surface of the optic nerve, a little anterior to the attachment of the muscles; the third pair (*moteur commun*), which enters the orbit through the foramen lacerum (sphenoidal fissure), crossing the posterior extremity of the rectus externus muscle: the superior branch of this nerve is lost in the rectus superior and levator palpebræ; the inferior gives off a large twig to the rectus inferior, another to the obliquus externus, a third which passes under the optic nerve to be distributed to the rectus internus, and lastly a filament which forms the inferior root of the lenticular ganglion. Next we find the abductor oculi (*moteur externe*), or sixth pair, which penetrates the orbit through the same foramen as the preceding, and immediately enters the rectus externus muscle. All these branches are at first situated on the outer side and around the optic nerve, and are afterwards dispersed among

the five essential motores muscles of the eye. The researches of Chas. Bell * induced him to think that these nerves presided over the voluntary motions within the orbit. The fourth pair (*pathetici*), according to the same author, preside over the instinctive movements of the trochlearis muscle, and are therefore congenial with the filaments of the facial, which are motors of the orbicularis palpebrarum muscle. In fact, at the moment of sleep, as well as at the approach of death, at the same time that the upper eye-lid falls the eye is raised by the action of the trochlearis, because the will no longer has power over the recti muscles, etc., which alone obey its orders. On the other hand, if we destroy the facial nerve, the eye-lids will remain open and immoveable, whereas the eye continues to move under the influence of the will. The patient from whom Beclard extirpated the parotid gland, presented a striking example of this fact † It must be remarked, however, that in another patient, who came under the notice of M. Billard, ‡ the side of the face was paralysed in consequence of the destruction of the facial nerve, nevertheless, the palpebræ continued moveable.

Some nerves of another order are also met with in the orbit: these are filaments of the ophthalmic branch of the fifth pair (trigeminus), which, according to modern research, seem to appertain exclusively to the sensitive function of the parts to which they are distributed: from which circumstance, if the trunk of the nerve is divided, the subject can no longer feel the contact of bodies applied to the eye-lids, eye, etc., as has been observed in a woman by Dr. Crampton, and in animals by M. Magendie.

The lachrymal branch, before it is lost in the gland of the same name and the external angle of the eye-lids, gives off two small filaments which pass through the os malæ in order to be distributed to the check and temporal fossa, and also form with a branch of the inferior maxillary the superficial temporal. It is situated between the rectus externus and the periosteum.

The supra-orbital, placed upon the superior surface of the levator palpebræ muscle, before passing out of the orbit anastomoses by its internal frontal branch with the nasal. As the latter passes

* Philosophical Trans. etc., 1823. and an Exposition of the natural system of the nerves, etc. London 1824.

† Archives, Janvier 1824. ‡ Archives November 1824.

over the optic nerve, it gives off the superior root of the ophthalmic ganglion; it then approximates the inner wall of the orbit, running between the trochlearis and adductor oculi, where it gives off the ethmoidal filament and afterwards comes out at the great angle.

Finally, the superior maxillary nerve sends into the orbit the infra-orbital, which is at first half uncovered in its groove, but afterwards completely enclosed in its canal, previous to its entrance into the fossa canina; it also gives off the orbital filament, which anastomoses with the lachrymal and deep-seated temporal branches, and which follows the direction of the sphenomaxillary fissure.

3d. The *arteries* of the orbit are derived from the ophthalmic, and have nearly the same distribution as the nerves; There are none so large as to require important surgical remarks. The supra-orbital only may be wounded in fractures of the vault of the orbit: and the meningeal media sometimes sends a considerable branch through the sphenoidal fissure which supplies the place of the lachrymal. In the extirpation of the eye it is never necessary to tie these branches; their position and relations with the bones enable us to compress them readily. As they are derived from the carotids, it has been recommended to tie the latter in cases of aneurism within the orbit, and the operation has been performed by Mr. Travers of London.

4th. The *veins* are larger than the arteries, which they generally accompany. There is usually one of larger size than the others, which passes from the face to the Sella Turcica, and forms a direct communication between the angularis and ophthalmic veins. By this communication we may partially account for the ready transmission of diseases of the organs contained within the orbital cavity to the encephalon, and *vice versa*. By it, also, we may perceive that the opening of the facial vein, in diseases of the eye, would produce a very prompt disgorge ment, and probably we neglect this resource too much. All of these veins enter into the cranium through the sphenoidal fissure (*foramen lacerum*), and form, previous to their termination in the coronary sinus (*sinus circularis of Haller and Sæmmering*), a more or less complicated plexus, which might be called the *ophthalmic plexus*.

5th. The *Lymphatics*. Some of them are continuous with those of the face and proceed to the base of the lower jaw; the

others pass through the spheno-maxillary fissure into the parotidial region.

6th. The *lacrimal gland* is concealed behind the external orbital process, and is so difficult to remove that, after the extirpation of the eye, we are generally obliged to dissect it out separately.

All the organs which have just been enumerated are separated by very large adipose cells, which are never entirely wanting, even in the most emaciated subjects. This fat is soft, almost semi-fluid, and forms an elastic cushion, which favours the movements of the eye, and prevents the recti muscles from drawing it backwards. Also, in consequence of the laxity of the cellular tissue which surrounds this organ, inflammations of the interior of the orbit promptly terminate in suppuration, and this suppuration rapidly detaches and disorganizes a multitude of important parts.

7th. The *Periosteum* of the orbit is a complex fibrous expansion, which seems to originate from the dura mater. As it enters this cavity it divides into two sheets, one of which embraces the optic nerve, and is confounded with the sclerotica; the other lines the bones, is reflected upon them at the base of the orbit, and seems to produce the palpebral ligament, on the one hand, and to blend itself with the periosteum of the forehead, on the other.

8th. Lastly, the *bones*, which are numerous, and several of them present some striking peculiarities. The superior paries, or vault, is formed by the orbital portion of the os frontis, except in its posterior tenth, where we find the small ala of the sphenoid, which is perforated obliquely forwards and outwards by the optic foramen. Through this hole the optic nerve and artery pass; above it, between the laminae of the periosteum, the superior rectus and levator muscles originate, one above the other; and between them, but a little more internally, the trochlearis. That portion of the vault which appertains to the os frontis is so thin and brittle that it might be perforated by the point of the bistoury in extirpating the eye, if proper precautions were not taken. The tenuity of the bone also renders it objectionable, in this operation, to apply the actual cautery upon the parts which might be attached to it, because the dura mater and the anterior

lobe of the cerebrum would be acutely irritated by the evolution of the igneous particles. It is also in consequence of this anatomical disposition that instruments penetrating into the upper part of the orbit so frequently give rise to serious accidents, even death itself. In fact, they traverse the bone with the greatest facility, and then lacerate the brain. Finally, it is through this part that balls get into the cavity of the cranium, when they have entered by the orbit; it is through this that Garengot, J. L. Petit, etc. have seen ram-rods, swords, etc. penetrate into the skull and occasion death, and it is but recently we observed a case, in a student at law, who died at the hospital of la Faculté, where a ball passed into the cranium at this part, crossed the whole extent of the lateral ventricle, tearing up the parietes of this cavity, and lodged in one of the superior occipital fossæ.

On the outer side of this paries, and near the edge of the orbit, is the fossette in which the lachrymal gland is situated. This excavation is sometimes pretty deep, and requires attention when we extirpate the eye, if we wish to remove the gland at the same time.

The floor of the orbit is triangular, but more plane than the latter. It is formed, anteriorly and externally, by the os malæ; in its most posterior part, by the superior surface of the orbital process of the os palati, and throughout the rest of its extent by the superior wall of the maxillary sinus. The two sutures which unite these three bones, adhere pretty firmly to the periosteum, and give passage to some small emissary veins. This paries is grooved out in its two posterior third portions by the infra-orbital gutter, through which the nerve, artery and vein, of the same name, take their course; these organs, therefore, may be wounded by an injury inflicted upon the floor of the orbit. The anterior third of this gutter is converted into a canal, which conducts the same organs into the fossa canina. As the floor of the orbit is very thin, and corresponds to the maxillary sinus, tumours which are developed in the latter cavity tend to compress the eye, and, if greatly enlarged, to thrust it outwards. Pointed instruments also may easily penetrate into this sinus; hence it has happened that surgeons, in operating for fistula lachrymalis, by directing the point of the bistoury too much outwards or backwards, have thrust it

into this cavity, and afterwards have introduced the canula into the same place, considering it to be the nasal canal.

The internal wall, placed in the direction of the horizontal axis of the head, is formed, anteriorly, by the posterior half of the external face of the os unguis, upon which the muscle of Horner is attached, and by the plane surface of the ethmoid; at its most posterior part, by a small portion of the sphenoid bone. The sutures which connect these bones, and those which unite them to the superior and inferior parietes, present nothing remarkable, unless it is the fronto-ethmoidal, in the tract of which we meet with the internal orbital foramina, through which the ophthalmic artery and nerve send branches into the cells of the ethmoid, to the dura mater and nose. This wall is also very thin, and might easily be fractured during the extirpation of the eye. For this reason we consider it best, in performing this operation, to introduce the curved scissars flat-wise along the internal side of this organ, in order to divide its pedicle, rather than to pass it along the external paries.

The external wall is formed by the os malaë anteriorly, and by the great ala of the sphenoid posteriorly; it is firm and solid, and corresponds to the temporal fossa; it is separated from the vault by the sphenoidal fissure. This fissure encloses internally, where it is broadest, a pedicle, from which arise, in part, the superior, external and inferior recti muscles; the third, fourth, ophthalmic branch of the fifth, and sixth pair of nerves; the lachrymal vein. A cutting instrument might be easily pushed through it, and wound the middle lobe of the cerebrum.

The spheno-maxillary fissure separates the external and inferior regions of the orbit. Less complicated than the preceding, it is filled with fat and a dense fibro-cellular tissue; we also see in it the infra-orbital nerve and vessels. Foreign bodies entering in at the eye, or orbit, might easily penetrate through it into the zygomatic and pterygo-maxillary fossæ; therefore, in the extirpation of the eye, we should be careful how we dip the bistoury in this direction, for we might wound the internal maxillary artery, the supra-maxillary nerve, the ganglion of Meckel, etc.

This external wall is very oblique outwards, which makes it appear shorter than the internal. The conjoined base of these

four surfaces forms the orbitary circle, which is obtuse and rounded in its internal half, but more or less acute in its external portion. Therefore, in extirpating the eye, we should introduce the bistoury at the great angle, carry it along the internal paries, and afterwards follow the inferior semi-circumference of the orbital cavity until it reaches the temporal angle, then bring back the instrument to the point where first introduced, and complete the circle by following the superior paries. This method is not only the most speedy, but it is likewise attended with less risk of introducing the point of the instrument into the sphenoidal and sphenomaxillary fissures than if we should commence at the external angle. In the first incision, according to this process, we only separate the palpebral from the ocular conjunctiva, the external oblique muscle, and the cellular tissue which unites the muscles to the orbit; in the second, we cut the double tendon of the trochlearis and a layer of cellular tissue, which is a little more dense than inferiorly. Then the lachrymal gland is separated from its fossette, if we carry the bistoury sufficiently near the bones. The eye is now connected to the apex of this cavity merely by a pedicle, which is composed of the four recti, trochlearis, and levator palpebræ muscles, of the ophthalmic vessels, optic nerve, and all the other nerves of the orbit; which pedicle is easily divided with one stroke of the scissars.

The apex of the orbit being very narrow, the eye is with difficulty drawn back into it, even if there should be no fat to prevent it.

Sect. 4. Zygomato-Maxillary Region.

It comprises all the parts which compose the pommette* (malar protuberance), on the one hand, on the other the canine fossa, and all the organs which cover it. It is bounded, superiorly, by the orbitary region; inferiorly, by the genial region; externally, by the temporal and masseteric regions, and internally, by the nasal region.

This region presents, superiorly and externally the jugal eminence, which is more or less sharp or rounded, more or less prom-

* *Pommette*—the name which French anatomists give to the prominent part which the face presents below the external angle of each eye. This part is formed by the integuments and os malæ.—*Transl.*

inent, according to the nation, age, sex, and individual, and which has much influence over the expression of the countenance. Internally, and below this protuberance, there is, in many subjects, a groove, which runs obliquely downwards and outwards, extending from the great angle of the eye to the genal region, and separating the fossa canina from the malar protuberance (*pommelte*): this is the naso-jugal furrow,* above which we find the orbicularis palpebrarum and superior portion of the zygomatic muscles, which it crosses; below it are the levators of the nose and lip, and the buccinator. Another oblique furrow extends, in the same direction, from the ala nasi to the angle of the lips; this is the naso-labial furrow, which separates the labial region from the one under consideration, and which is more constant than the preceding.†

CONSTITUENT PARTS.

I. *The Skin.*

It is generally smooth and delicate, more highly coloured upon the jugal prominence: it is upon this point that the febrile blush appears in pulmonary inflammations, that the yellow or dirty tint is manifest in diseases of the liver and internal suppurations. Inferiorly, and externally, but in man only, it is covered with a few hairs; a great number of follicles exist in it, in which *tannes* (*acne punctata*) sometimes form and sometimes undergo chronic enlargement forming what are called the *gutta rosea*.

II. *The Adipo-Cellular Tissue.*

It forms a layer which varies in thickness according to the degree of obesity of the individual, and also according as it corresponds to the muscles or their interstices. Upon the malar eminence it is dense, filamentous and contains but few adipose cells; and as it is the only part which exists between the skin and the

* M. Jadelot calls this furrow the *oculo-zygomatic trait*, and considers it a diagnostic sign of diseases of the cerebro-spinal system in children.

† This M. Jadelot calls the *nasal trait*, and refers it to affections of the abdominal organs.

bones, it is consequently very adherent in this situation; therefore, it is important, when we operate upon the face, to preserve as much of this adipo-cellular tissue as possible, otherwise, from its unyielding nature, the lips of the wound will not come into contact so as to unite by the first intention. Internally and inferiorly the cellular layer is very thin, and the adipose vesicles which it contains are small and few in number: it unites the skin intimately to the levatores labii superioris et alæ nasi. This compact union renders its inflammations very painful, and gives them an erysipelatous rather than a phlegmonous character. In the fossa canina the cellular lamellæ are more lax; the adipose vesicles very large and numerous. They dip between the muscles, fill the osseous excavation, and communicate with those of the *genial* region. They envelope all the vessels and nerves, and as they do not adhere firmly to the skin, it follows that we can bring its wounds together by means of straps, bandages, or sutures, better than upon the malar eminence, so as to induce them to heal by the adhesive union. Finally, as this cellular layer is thicker and its meshes farther asunder in the canine fossa than internally and externally, it follows that inflammations are more frequent in it, and more liable to terminate in suppuration.

III. *The Muscles.*

In this region we find, in proceeding from the nose towards the malar eminence the levator labii superioris alæque nasi, the levator labii superioris proprius and the zygomatici muscles which converge as they descend, and adhere to the skin or are separated from it by the cellular layer only. It is necessary to keep in mind their direction when we operate upon the face, because their transverse section would derange the motions of the mouth. Behind the first, consequently deeper seated, we find the dilatator vel compressor naris (*transversal du nez*), concealed by the levator communis, and the levator anguli oris which partly covers the levator proprius and sometimes a small portion of the zygomaticus minor. The levator anguli oris is separated from the internal membrane of the lips only by a thin but dense laminated tissue. Between the inferior loops of the orbicularis palpebrarum, the levator proprius and zygomatici, there is generally a consid-

erable space, which is filled only by the cellulo-adipose layer, vessels and nerves, and by which we penetrate into the fossa canina.

IV. *The Arteries.*

They either terminate in this region or simply pass through it. The infra-orbital artery comes out of the sub-orbital foramen, which is opposite to the middle of a line drawn from the inferior margin of the os nasi to the lower part of the malar eminence, and enters the canine fossa. It is situated behind the levator proprius muscle, on a level with its external border, before and above the levator anguli oris. It is separated from the os maxillare superius by the nerves and cellular tissue, and from the orbicularis palpebrarum muscle, by the facial vein and adipose vesicles. This artery is distributed to the nasal and labial regions, and anastomoses with their proper vessels. The transverse facial artery, which terminates in this region below the jugal prominence, is sometimes so large as to occasion hemorrhage; but, as it creeps through a lax lamellated tissue, it may be readily secured, if it should become necessary. The facial artery generally runs along the internal and inferior limits of this region, traversing the levatores anguli oris et labii proprius, behind the naso-labial furrow; it then reaches the great angle of the eye, where it anastomoses with the ophthalmic, after having received the name *angularis*.

V. *The Veins.*

The facial vein is the only one which merits some attention. It does not follow the direction of the arteries, which, for the most part, (the infra-orbital excepted) have no *venæ comites*. This vessel runs in an almost direct line from the internal angle of the eye, and seems to be the continuation of the frontal: near its origin it communicates with the veins of the orbit; before the masseter, as it passes beneath the naso-jugal furrow, it is subcutaneous, or covered, superiorly, by the inferior fibres of the orbicularis palpebrarum muscle: inferiorly, it is enveloped in the cellulo-adipose tissue which separates the zygomatici from the

levator anguli oris and buccinator muscles, and is crossed anteriorly by the ramifications of the facial nerve; posteriorly by the buccal and infra-orbital nerves.

VI. *The Lymphatics.*

They are few in number and pass to the submaxillary lymphatic glands. No absorbent glands have as yet been discovered in this region.

VII. *The Nerves.*

We here find the termination of the superior maxillary or infra-orbital nerve, which is at first situated on the outer side of the artery; its branches then diverge and are lost in the skin of the lips, nose, cheek and that which covers the inferior orbital arch, anastomosing in most of these points with filaments from the fascial. When we are perfectly satisfied that this nerve is the cause of the *tic douloureux* of the face, and desire to divide it, we may easily fall upon it, between the orbicularis palpebrarum and the origin of the levator labii proprius, by cutting upon the naso-jugal furrow. We would then have to reflect the facial vein outwards, and the levator inwards; the skin and cellular tissue being thus divided, we will see the nerve very near the origin of the levator anguli oris. This method appears to us to be more simple than that of Langenbeek.*

The zygomato-maxillary region also receives numerous filaments from the temporo-facial branch of the respiratory of the face (*portio dura*). They generally cross the anterior surface of the vessels, and are at first enveloped in the subcutaneous layer; afterwards, lost in the muscles. The investigations and experiments of Shaw, Charles Bell, etc., render it probable, if not certain, that the muscular movements of this region are under the influence of the *portio dura*; whilst the infra-orbital nerve presides over the sensitive functions. There are also some small filaments from the lachrymal which anastomose upon the os mæ; but they can only serve to explain some sympathetic affections.

* Bibliothéque Chirurg. No. de 1821.

VIII. *The Skeleton.*

In this region we find the *os maxilæ*, which, although possessing considerable solidity, is nevertheless exposed to fracture, on account of its superficial situation, externally especially, where it is no longer supported by the superior maxillary bone. From it the two zygomatic muscles originate ; but more superiorly, and posteriorly, it is only separated from the skin by the dense cellular tissue before mentioned, by the malar branches of the facial nerve, the malar twigs of the lachrymal artery and nerve, as well as the transverse facial branch. In consequence of this dense, nervous and vascular texture, the inflammations which occur upon the malar eminence are very painful, and the skin which covers it is more sensible and higher coloured. The *os maxillare superius* presents, in this region, all the anterior wall of the antrum, into which it would be much easier to penetrate, by following the method recommended for the division of the infra-orbital nerve, than by acting upon the obtuse crest which separates the fossa canina from the malar tuberosity, as recommended by Lamorier. This wall of the sinus is so thin and brittle, that it might be perforated without much difficulty, even by an instrument with a rounded extremity : but then the anterior dental nerves, derived from the infra-orbital previous to its entrance into the fossa canina, must be torn or stretched out of their place. How much more liable then is it to be traversed by a pointed instrument : a small sword, for instance, if thrust violently upwards and backwards, might even penetrate through the floor of the orbit, after having passed through this sinus, and thus wound the different parts contained within it ; and if the force with which it is pushed is not exhausted, it will break through the orbitary vault, and entering the cranium, lead to mortal consequences. The position of this sinus also permits polypi, which are developed within it, to become prominent upon the face, after having destroyed its anterior paries. The periosteum in this region, is not very compact upon the maxillary bone, and it is easily separated from it by inflammation. This, therefore, accounts for necrosis and caries being very frequently attendant upon diseases of the teeth. etc.

Sect. 5. The Masseteric Region.

It is bounded by the margins and attachments of the masseter muscle. Consequently, we find anterior to it the zygomato-maxillary and genial regions; posteriorly, the parotideal; superiorly, the temporal; and inferiorly, the supra-hyoideal regions.

Upon the face of most subjects, it forms a prominence which varies in proportion to the size of the parotid and masseter, and especially to the inclination of the angle of the jaw.

CONSTITUENT PARTS.

I. *The Skin.*

This is thicker than the skin of the parotideal and genial regions, and of a compact, unyielding texture. In man, it is covered with a great number of hairs, contains also sebaceous follicles, but presents nothing remarkable in a surgical point of view.

II. *The Subcutaneous Layer.*

This layer is seldom very thick, and consists of a lamellated cellular tissue, which becomes blended with the fascia of the parotideal and supra-hyoideal regions, is lost anteriorly in the cellular tissue of the genial region, gives a sheath to the canal of Steno, envelops the superficial nerves and vessels, and is separated from the skin by some fibres of the platysma. This stratum may therefore be considered as being formed of two cellular laminae; one of which is immediately beneath the skin, and sometimes envelops a considerable quantity of adipose vesicles; the other, which is more dense, invests the masseter, and forms a complete aponeurosis; whence it follows, that, in wounds of this region, we may employ uniting means with much more advantage than in the other points of the face; whence, also, tumours and abscesses which form under the second lamina, remain for a long time flattened, and become of considerable breadth before they elevate the skin; whereas the same affections, when developed beneath the first lamina, soon become quite prominent. These

peculiarities should be attended to, as they will assist us in forming our diagnosis or prognosis of certain diseases.

III. *The Muscles.*

There is only one muscle on the outer side of the jaw, which is the masseter. It originates from the inferior border of the zygomatic arch to within a few lines before its horizontal ramus. The posterior, anterior and middle fibres run forwards, backwards, or directly downwards, but do not constitute three muscles, as Winslow describes it. The masseter muscle cannot, when the jaw is depressed, assist in luxating this bone; but, at the moment the condyle is about to pass into the zygomatic fossa, its posterior fibres may draw the maxillary angle upwards, and thus concur in the depression of the chin. This muscle is frequently the seat of rheumatism, which may be accounted for by the quantity of fibrous tissue entering into its composition. Its fibres being parallel to the axis of the body, and no important vessel crossing it, the incisions which we make in this region should be as near the perpendicular as possible. We must pay attention, however, to the parotid duct which crosses the superior part of this muscle.

IV. *The Arteries.*

The superficial branches are derived from the external carotid and facial, a deep branch from the internal maxillary. The transverse facial originates from the former; it crosses the muscle, enveloped in the laminæ of the aponeurosis, four or five lines below the zygomatic arch, and one or two lines above the parotid duct; it then enters the zygomato-maxillary and genial regions, and anastomoses, inferiorly and anteriorly, with the twigs which are detached from the facial as it passes before the masseter. It is sometimes so large as to occasion hæmorrhage. There are, in certain individuals, one or more transverse facial arteries below the canal of Steno, but they are generally so small that they scarcely deserve surgical attention. The masseteric artery, in its course to this muscle, passes through the sigmoid notch, before the maxillary condyle, behind the tendon of the temporalis and above

the pterygoideus externus, so that it may be compressed or lacerated when the condyle of the lower jaw is luxated or fractured.

v. *The Veins.*

They are of but little importance to the surgeon: some of them accompany the arteries, the others take a distinct course. They generally form a communication between the facial and external jugular veins; but they empty more especially into the latter.

vi. *The Lymphatics.*

These vessels are more numerous in this than in the other regions of the face, and pass into the submaxillary and parotid lymphatic glands; whence the rapid engorgement which takes place in the latter organs in some diseases of the masseteric region.

vii. *The Nerves.*

One of them comes from the inferior maxillary, follows the masseteric artery, and is lost in the masseter muscle. The others are the temporo-facial and cervico-facial branches of the respiratory nerve of the face. The first forms a complete network in the aponeurosis above and below the duct of *Steno* and the transverse facial artery. The filaments of the second being less numerous, it follows that wounds are less dangerous in the inferior than the superior part of the region.

viii. *The Canal of Steno. (Parotid Duct.)*

This canal having emerged from the parotid, crosses the masseter, upon which it is immediately applied. We have previously said that it received a sheath from the aponeurosis. It is covered by nerves, the largest of which run above it, and upon its superior margin also lies the transverse facial artery. It is situated eight or nine lines below the zygomatic arch, posteriorly; three or four only, anteriorly. Between it and this arch there is some-

times a distinct glandular lobule, which is the accessory of the parotid. The presence of this canal must make us very circumspect in forming our diagnosis or prognosis of wounds or ulcers of this region, as well as in the performance of operations upon it. In fact, as it is more or less superficial, in proportion to the *embonpoint* of the individual, it might be readily opened and give rise to fistulous wounds of very difficult cure; especially, as salivary fistulæ, in this situation, do not admit of the employment of M. Deguise's method, the only chance of success being afforded by the use of the caustic or setons.

IX. *The Skeleton.*

It comprehends the zygomatic arch and the whole ramus of the jaw. The superficial position of the arch, and the slenderness of the bones which compose it, render it very susceptible of fracture from a direct cause. These fractures are not dangerous from the derangement of function which the displaced fragments produce, but in consequence of the inflammation and abscesses which may supervene in the temporal or zygomatic fossæ. An instrument introduced under this arch would easily penetrate into the zygomatic fossa, and even enter the cranium, if its point was directed slightly upwards; from which might result a wound of the middle meningeal artery, etc.

The ramus of the inferior maxillary bone presents, in this region, three points for consideration: 1st. the angle, which is curved outwards in some individuals, and upon which the principal force is applied in indirect fractures of the body of this bone: 2d. the condyle, which may be fractured at its neck, and as the pterygoid, in this case, draws its inferior portion forwards, the reduction is rendered very difficult; 3d. the coronoid process, which prevents the luxation of the condyle, excepting when the jaws are extensively separated; for otherwise, it would be checked by the posterior face of the os mala. As this process is enveloped by the tendon of the temporal muscle, if it was detached from the rest of the bone, it would be drawn towards the temporal fossa. In the interval of these three parts, the ascending portion of the jaw is entirely covered by the attachments of the masseter; so that a fracture of this part will rarely

be attended with displacement. Internally, this bone forms a part of the zygomatic fossa, which, as it may be considered an appendage to the masseteric region, we will now examine.

This fossa encloses the two pterygoid muscles, which are so disposed that the external is rather a depressor of the lower jaw than its elevator. Between these two muscles, we find the inferior dental artery and nerve, the internal ligament of the articulation, the lingual branch of the fifth (*gustatory*) etc., descending in an oblique direction; quite internally, the levator and circumflexus palati, and the superior constrictor pharyngeus: the space which intervenes between the latter and the former is filled by a lamellated tissue, and frequently by a process of the parotid gland. It is in the upper part of this space that we find the different branches of the inferior maxillary nerve enveloped by the fibres of the origin of the external pterygoid. Consequently, we also find here the auricular nerve, which originates from the trunk by two roots, between which the middle meningeal artery passes; the gustatory and dental, which here form a communication with each other by means of a cord of greater or less volume; the gustatory also receives, in this situation, the corda tympani. These three branches are situated behind the external pterygoid. We also see, in the fibres of this muscle, above or before it, the masseteric, temporal, buccal, and pterygoidean twigs; whence it follows that the former would be easily reached by an instrument which would traverse the sigmoid notch* of the inferior maxillary bone; but if we wish to divide them, we can only succeed by detaching the parotid and the arteries from the posterior margin of the jaw, between the two branches of the facial; and even then we might only reach the dental and gustatory.

The internal maxillary artery and its thirteen branches are also distributed in this fossa; all these branches, except the meningeal media, are accompanied by veins which empty into the jugulars, and which establish relations in the circulation between the nose, orbit, and parotideal region, which the pathologist should not be ignorant of.

At the anterior part of the bottom of the zygomatic fossa is

* The sigmoid notch separates the condyle from the coronoid process.—*Transl.*

the pterygo-maxillary fissure, in which we find, from above downwards, the superior maxillary nerve, which passes from the cranium into the orbit, the sphenopalatine ganglion and the origin of its vidian, palatine, sphenopalatine, etc. branches; the termination of the internal maxillary artery, which there gives off the sphenopalatine, pterygopalatine, vidian and superior palatine arterial branches. We may easily pass an instrument through the sphenopalatine fissure of the orbit into this fossa, and we perceive how dangerous wounds in this point would be. The bones which compose the pterygo-maxillary fossa are somewhat numerous. Its anterior paries is formed by the posterior part of the superior maxillary bone, which is perforated by a great number of small holes for the transmission of the superior and posterior dental filaments, and which will bulge out more or less, according as the last molar tooth is contained within it or not. It is in the upper and outer part of this paries that we see the commencement of the infra-orbital groove. The anterior surface of the pterygoid process, perforated at its base by the Vidian foramen, forms the posterior paries; the internal is constituted by the external surface of the os palati. It is hollowed out and converted inferiorly into a canal, in the formation of which the anterior paries of the fossa concurs: this is the posterior palatine canal, along which the artery and nerve of the same name pass to the mouth. In the upper part of this paries, we see the pterygopalatine foramen, through which vessels and nerves penetrate into the nasal fossæ. Polypi of the nose might also make their way through this foramen, and thus get into the zygomatic fossa. We saw a remarkable case of this kind in 1823. The superior paries of the zygomatic fossa does not exist, properly speaking; it falls into the sphenoidal fissure and enters the cranium.

The bones which enter into the zygomatic fossa, properly so called, are, anteriorly, the concave part of the os maxillæ, then the external surface of the molar portion of the supra-maxillary bone; superiorly, the zygomatic portion of the great ala of the sphenoid, to which the external pterygoid muscle is attached; internally, the external surface of the pterygoid process; and externally the ramus of the jaw, in the middle of which we observe the orifice of the dental canal: a disposition which explains why fractures

of the neck of the condyle, &c., less frequently produce serious accidents than those which correspond to this foramen.

Sect. 6. The Genial Region.

It is wedged as it were between the mental, labial, zygomatico-maxillary, masseteric and sub-maxillary regions. Its limits cannot be otherwise than arbitrary, and its surgical importance is particularly derived from salivary fistulæ and the passage of the facial artery. It is sometimes prominent, at others excavated, and in many individuals it presents one or two fossettes, which are owing to the contraction of the muscles.

CONSTITUENT PARTS.

I. The Skin.

The skin is delicate and smooth in women and children, but in man it is covered by the hairs of the beard; and although it is not intimately adherent to the subjacent parts, yet it does not move so freely over them as in the masseteric region.

II. The Cellulo-Adipose Tissue.

It forms a considerable mass anterior to the masseter, between the buccinator and the integuments, and is thereby continuous posteriorly with that of the temporal fossa: which explains the manner in which abscesses of one of these regions communicate with the other. The absence of this fatty mass occasions the excavation of the cheeks in thin persons. Inferiorly and anteriorly, the adipose cells become smaller and smaller, and at length terminate by uniting intimately with the muscles and the skin, so that phlegmonous abscesses are more easily formed posteriorly.

The cellular tissue is dense or lax, in proportion to the thickness of the adipose layer. Its quantity does not vary; but its lamellæ are more or less separated from each other, according to the volume of the adipose vesicles. It is from this that the masseteric aponeurosis seems to originate.

III. *The Muscles.*

The facial portion of the platysma frequently forms a triangular bundle, the base of which is at the masseter and the apex at the angle of the lips. This muscle (*risorius Santorini*) is sometimes very strong, and its contractions occasion those dimples (fossettes) just spoken of, which add to the beauty of the female countenance. It is situated in the lamellæ of the subcutaneous cellular tissue. In the inferior part of this region, and separated from the skin by the platysma, is the depressor anguli oris, the fibres of which converge as they approximate the labial angle. The buccinator is the principal muscle in this region. Posteriorly, it is separated from the skin by the adipose mass previously spoken of, and by the platysma; anteriorly, it is almost in direct contact with it. Its external surface is covered by a fibrous expansion which is given off by the parotid duct before it perforates it: this expansion, being prolonged backwards, becomes blended with the bucco-pharyngeal aponeurosis, which attaches itself to the base of the coronoid and to the internal ala of the pterygoid process. A foreign body, a sword, for example, thrust between this aponeurosis, which is internal, the masseter and coronoid process which are external, might penetrate into the zygomatic fossa, even to the bottom of the parotidæal region, and thereby wound the internal maxillary artery, the inferior maxillary nerve, the internal carotid and jugular, the paravagum, great sympathetic, etc. Internally, the buccinator is separated from the buccal membrane by a dense and thin cellular lamina, in which is found, posteriorly, the molar glands, which are sometimes very large, being perfect glands, each possessing their excretory duct, and not simple follicles. When we are obliged to make incisions on the inner part of the cheek we should recollect that the fibres of the buccinator are nearly horizontal.

IV. *The Canal of Steno.*

It is accompanied by a considerable branch of the facial nerve and terminates in this region by curving over the anterior margin of the masseter, four or five lines before which it penetrates

the buccinator: it is then also about four lines distant from the malar eminence. From this disposition, then, it follows, that the operation of M. Deguise for the cure of salivary fistulæ is not so simple as might be supposed; for the posterior extremity of the canula or tent must traverse a considerable thickness of parts before it reaches the mouth; besides, this method can seldom be applicable, since it can only be resorted to when the disease exists some lines anterior to the masseter. Now, the short tract which the canal has to traverse in this place, and its depth in this situation, prevents its being frequently wounded at this part. We may say the same of the advice which we gave in 1823,* i. e. to introduce an instrument into the mouth, and make an opening in the canal nearer the gland than the fistulous aperture in the skin. So with the methods of Leroy, J. L. Petit, Duphenix, etc. in which the rule is to perforate the cheek in any manner whatsoever. The walls of the parotid duct are much thicker in the genial region, so that its volume is considerably augmented; but when it is about to perforate the buccinator, it leaves upon the external surface of this muscle the fibrous envelope which it had derived from the parotideal aponeurosis; so that it is much more slender between the fleshy fibres than before it penetrated them. Its internal opening is four or five lines below the point where the mucous membrane unites with the gums, and generally opposite the last molar tooth but one. From the masseter to the orifice, the canal of *Steno* represents an arc of a circle the convexity of which looks forwards and outwards. Hence the utility of everting the fore part of the cheek with one or two fingers introduced into the mouth, whilst we push inwards with the thumb the portion in proximity with the muscle, as recommended by Louis, when we wish to introduce a stylet, probe, seton, etc. into it. It is in fact this curvature, and the laxity of the organ, which oppose the introduction of instruments into the duct by the mouth, and not a pretended valve, which does not really exist.

v. *The Arteries.*

The only artery of importance in this region is the facial. It

* Thèse inaugurale.

enters the region at the lower part of its posterior boundary ; that is to say, before the masseter. In this situation it lies upon the bone, behind the depressor anguli oris, being separated from the skin merely by cellular tissue and the platysma ; so that we are able to make firm compression upon it here, when about to operate upon the face. It would also be very easy to apply a ligature around it, if any diseases of the organs to which its branches are distributed should seem to demand it. If, when we wish to compress it, the edge of the masseter is not sufficiently evident through the skin, we should carry the finger forwards from the angle of the jaw, when we will soon meet with a superficial notch in which the artery is always placed. As the facial artery takes its serpentine course from this point towards the zygomato-maxillary region, it follows the direction of the posterior fibres of the triangularis (*depressor anguli oris*), which it traverses in order to enter the zygomato-maxillary region : the inferior coronary is given off from it whilst it is still in the genial region. It also gives off a great number of small branches, which anastomose posteriorly with the transverse facial, anteriorly with the mental, and superiorly with the infra-orbital : all these branches, in fact, terminate in part in the region under examination. We likewise find here the buccal coming from the internal maxillary, upon the external surface of the buccinator muscle, and communicating internally with the alveolares and inferior dental ; these twigs, however, are of no importance in surgery.

vi. *The Veins.*

The large facial vein alone merits some attention. In the zygomato-maxillary region, it was remote from the artery ; as it traverses the genial region, it approximates it, and at length covers it, when about to pass into the supra-hyoideal region. This want of parallelism between the two principal vessels of the face, is owing to the vein being free from curvatures in its course from the great angle of the eye to the fore part of the masseter, whilst the artery, in passing through the same tract, is very tortuous. Furthermore, notwithstanding the magnitude of the vein at the lower part of the face, it would be dangerous to draw blood from it, on account of the proximity of the artery.

VII. *The Lymphatics.*

These vessels are as yet not well understood ; they are a continuation of those which were observed in the upper part of the face : they run into the submaxillary lymphatic glands. There are also some deep-seated vessels which pass to the carotic or submastoid cervical glandules.

VIII. *The Nerves.*

The nerve which appertains to this region is spread out upon the buccinator muscle, and for this reason is called *buccal* (n : buccinatorius). The others are, anteriorly and superiorly, filaments of termination from the mental and infra-orbital, which appear to be the nerves of sensation ; posteriorly, some filaments from the facial (*portio dura*), which rather appertain to motion. We have already mentioned that a considerable branch accompanied the superior margin of the parotid duct.

IX. *The Mucous Membrane.*

It is polished, delicate, very adherent to the cheek, and insinuates itself into the canal of Steno, which it lines as far as its radicles. It is by means of this mucous prolongation that the parotids sometimes become sympathetically inflamed in consequence of diseases of the mouth. Where this membrane is reflected over the dental arches (*alveolar processes*) it is very hard and thick, and forms the external part of the gums. Upon the latter, we discover neither follicles nor villosities ; but throughout the rest of the genial region, the mucous membrane is covered with a very distinct *epithelium*.

X. *The Skeleton.*

It includes that portion of the os maxillare inferius which is between the coronoid process and the mental foramen, as well as the external face of the superior and inferior dental arches, as far as the dens caninus. It should be noticed, that, when the inferior

maxillary bone is fractured in this region, the levator muscles being attached to the posterior fragment, keep it applied against the upper jaw. The anterior fragment, on the contrary, is liable to be drawn downwards by the depressors which originate from the os hyoides.

Sect. 7. The Mental Region.

This region is bounded on each side by the preceding; superiorly, by the inferior labial groove, and inferiorly, by the supra-hyoidical region. It forms the inferior part of the face, and makes a projection, which varies according to age, sex, *embonpoint*; age especially: in the middle of it, and inferiorly, we sometimes observe, during the elevation of the lower lip, a slight depression or dimple.

CONSTITUENT PARTS.

I. *The Skin.*

The skin is much thicker than that of the preceding regions, bearing a great resemblance to that of the cranium; that is to say, it is dense, compact, and very adherent to the subjacent tissues. It contains numerous small sebaceous glands, and is shaded with an abundance of hairs in man, which perforate it in a perpendicular direction, constituting the beard. When the cryptæ inflame, they give rise to the herpes pustulosus (*dartre pustuleuse d'Alibert*) of the chin; when the sebaceous matter accumulates in them, it produces those small, red and painful pimples, which are cured by puncturing their apex, and squeezing out a white concrete substance. If this accumulation takes place more slowly, the cryptæ become much larger, forming *tannes*.

II. *The Cellular Tissue.*

This is small in quantity, and does not form subcutaneous layers in this region; it is blended with the muscles, and is merely connected to the skin by very short and very close filaments; posteriorly, between the muscles and bones only, there is a certain

quantity of lamellated tissue. There are numerous very minute adipose vesicles here, and their size is never decidedly augmented; so that the embonpoint of the chin, strictly so called, can scarcely ever vary. It is in the cellular tissue nearest to the skin, between the fleshy fibres, that the bulbs of the hair are situated. The compact texture of the cellular element, its intimate union with the skin, and the very great density of the latter membrane, prevent the formation of abscesses in this region, and cause its inflammations to assume the erysipelatous character.

III. *The Muscles.*

Upon the sides we meet with a small portion of the depressor anguli oris, the fibres of which ascend obliquely backwards; more anteriorly, the quadratus genæ, the internal fibres of which blend themselves with those of its fellow on the opposite side; towards the labial region, some fibres of the platysma, which are intermingled with those of the preceding and cover the external surface of the depressor anguli; at the centre, in the triangle which exists between the quadrati, the superbus (*levator menti*). This small muscle arises by two fibrous pedicles from the two fossettes which are situated on each side of the symphysis: superiorly and posteriorly, it is invested by the mucous membrane; anteriorly, it is attached to the skin, and slightly covered by the quadratus. As its fibres are perpendicular to the axis of the body, it must, in contracting, approximate the skin to the jaw, elevate and protrude the lower lip.

IV. *The Arteries.*

Between the bone, the mucous lining of the lip, and the quadratus, we find, externally, the termination of the inferior dental (inf. maxillary) artery; inferiorly, some twigs of the submental which anastomose superiorly with other small branches from the inferior coronary; and lastly, some twigs which originate from the facial, below the giving off of the principal artery of the lower lip. These arteries, however, are too small to occasion troublesome hæmorrhage when the mental region is wounded. In operations, should it become necessary to tie them, we must

expect some difficulties, for they retract within the muscles, and as they are enveloped in a compact cellular tissue, it is not easy to seize them with the forceps: therefore in such cases it is better to use the tenaculum or compression.

v. *The Veins.*

They accompany the arteries: some of them are pretty large and subcutaneous, and descend into the supra-hyoideal region in order to terminate in the lingual vein. The superficial veins ramify principally in the skin; they may become varicose, giving rise to that more or less deep red colour of the chin, which is observed in many individuals.

vi. *The Lymphatics.*

Almost all of these vessels pass directly to the submaxillary lymphatic glands. Hence in most diseases of the chin these glandules tumefy with the greatest facility.

vii. *The Nerves*

They come from the neck, from the inferior maxillary bone, and from the genial region. The former are some filaments from the nervus mylo-hyoideus and from the submental branch of the cervical plexus; the latter are twigs derived from the inferior branch of the facial. All these ramuscles are superficial. The inferior dental nerve, which comes out through the mental foramen, is deep-seated, and is distributed to the muscles. It is so situated that if it should be the seat of neuralgia, it might be easily divided and without danger. For this purpose an incision should be made within the lip, on a level with the canine or first molar tooth, when the nerve will be found some lines lower down, in contact with the bone, covered by some lamellated cellular tissue, and the quadratus muscle.

viii. *The Skeleton.*

This consists of the body of the lower jaw simply, and pre-

sents, upon the median line, the symphysis, which possesses so little solidity in the child that the two osseous pieces may be separated in consequence of external violence,—a blow, for example; beneath this line, a small triangular surface, which is covered merely by the skin; and lastly, the mental foramen, quite near the limits of this region, opposite the first molar tooth: hence we may amputate a great portion of the chin, without including this foramen in the section; and in this case, the principal branch of the dental nerve will not be divided, so that the pain and accidents consequent thereto will be avoided. In this amputation, we are advised to saw the bone in such a manner that its two surfaces may be of the same length, that is to say, perpendicular to its direction; but it seems to us, that it would be better to cut them sloping, at the expense of the internal surface, because, otherwise, the curvature would not permit the two divided ends to touch in all their points, if we wished to keep them in contact. In the adult, the inferior maxillary bone is so thick in this region, that its direct fractures are almost impossible. The prominence which it forms is greatest in the child, on account of the absence of the teeth, and the obtuseness of the maxillary angle. In old age, it again becomes more prominent, which is owing to the falling out of the teeth, and to the angle, which was more approximated to a right angle in the adult, again becoming rounded off, and more obtuse. With regard to its periosteum, there is nothing peculiar. The muscles are separated from it by a cellular tissue, which is more distinct than the subcutaneous; hence its inflammations more frequently assume the phlegmonous character, and as the buccal mucous membrane is all that intervenes between it and the mouth, superiorly and posteriorly, these small abscesses always open into the latter. Furthermore, as all the tissues possess less density in this direction than towards the skin, abscesses, of whatsoever nature they may be, have a greater tendency to direct their course internally than externally. These collections should always be evacuated from within, whereby less pain will be produced, and unsightly scars prevented.

Sect. 8. The Labial Region.

This region comprehends the two lips, and is bounded, supe-

riorly, by the nose and the naso-labial furrow; inferiorly, by the mento-labial groove;* and, laterally, by the fossette at the angle of the lips; hence its figure is elliptical.

Superior Lip.

In the middle of its external aspect we observe a species of groove circumscribed by two crests which descend from the septum of the nose upon the free border of the lip. According to Blumenbach and some modern anatomists, these two crests would be the traces of the cicatrization of the three portions of which this lip is said to consist in the early stages of fœtal existence. According to this idea, also, the hare-lip would be owing to the cicatrization not being completed on one side: hence this congenital division would never exist on the median line, and if the union of the two lateral portions with the median should fail at the same time, there would be a double hare-lip. The free border of this lip forms a gentle curvature, which is concave inferiorly, and which is divided into two upon the median line by a gradual elevation. This eminence is the termination of that portion of the lip along which the groove, just pointed out upon its anterior surface, runs. Since this disposition enters into the normal conformation, we should endeavour to re-establish it when we perform the operation for hare-lip. It is on this account that we are recommended to make the first needle which passes through the lip, describe the arc of a circle, the convexity of which looks backwards and upwards.

CONSTITUENT PARTS.

1. *The Skin.*

It supports the moustachios in the adult male; it is a little thinner than that of the chin, and becomes more intimately blended with the subjacent tissues, in proportion as it approximates the free border of the lip. It also becomes thinner as it approaches this border, and suddenly changes its character, in

* According to the *physiognomical doctrine* of Dr. Jadelot this furrow constitutes the mental feature, and is concerned in affections of the chest.

order to form the delicate rosy pellicle which covers it, and which is reflected behind the lip under the name of the labial mucous membrane. The hairs which we observe upon it perforate it in the same manner as those on the chin. It also contains sebaceous follicles, which are subject to the same alterations as in the preceding region, but less frequently.

11. *The Cellular Tissue.*

Its texture is so delicate, and its quantity so inconsiderable, that it can scarcely be distinguished from the other elements, which are so blended together in the lips as to form but one homogeneous mass. The adipose vesicles are still smaller than in the mental region.

III. *The Muscles.*

We have to consider especially the superior half of the orbicularis oris. Upon the middle of the anterior surface of this muscle we frequently see two fasciculi, which ascend perpendicularly towards the sides of the nasal septum, and which correspond to the crests observed upon the surface. These are the nasales labii superioris (*incisifs supérieurs*). Behind the superior half of the orbicularis and the mucous membrane, upon the sides of the anterior nasal spine, we find the depressor labii superioris *alæque nasi* (*petit myrtiforme*) close to the bone. The convex border of the former receives, from the median line towards the sides, the terminations of the levator labii superioris *alæque nasi*, of the levator proprius, of the zygomaticus minor, of the levator anguli oris, of the zygomaticus major and of a part of the buccinator. The union of the orbicularis with the mucous membrane is less intimate than with the skin; it is effected by means of a thin layer of lamellated cellular tissue, in which we see a great number of labial glands. The mucous membrane itself is more easy to separate from the muscle in proportion as it approximates its point of reflexion upon the os maxillare; hence abscesses of the lip generally give way at this point.

IV. *The Arteries.*

In the first place we find the superior coronary which is given off by the facial where it passes through the fibres of the levator anguli oris, towards the external extremity of the naso-labial furrow. This coronary is placed three lines above the free border of the lip, in the posterior plane of the fleshy fibres, the direction of which it follows. Previous to forming its arched union with its similar of the opposite side, it gives off a considerable branch which ascends towards the septum. A transverse incision, upon the median line, would divide these ascending arteries and occasion hæmorrhage; whilst a wound in the same direction, but a little further outwards, would not produce it, unless it was prolonged as far as the naso-labial furrow, near which the facial artery also runs. The arc of a circle which the two superior coronaries united form, gives off an immense quantity of twigs which descend or ascend parallel to each other, and terminate for the most part in the labial glands and mucous membrane. These are the twigs which constitute that beautiful and complex net-work observed in the latter when the lip is everted. As the trunk of this artery is almost in immediate contact with the mucous membrane, we may readily feel its pulsations by applying the finger under the lip, and it is more easily wounded in this direction than from the surface. The artery of the ala nasi also sometimes gives a considerable branch to the upper lip; and not unfrequently the facial artery dips more or less into the orbicularis muscle, before it enters the interval of the nasal and zygomato-maxillary regions.

V. *The Veins.*

They are still larger and more numerous than the arteries, and ramify in the proper tissue of the lip, where they occasionally become varicose. This abundant supply of vessels, in the organ under consideration, accounts for the frequency with which erectile tumours form in it, and for the active species of tumefaction which it is susceptible of in the normal state. This remarkable vascularity, together with the intimate commixture of the differ-

ent elements which enter into the composition of the lips, also explains the rapidity with which they tumefy, and the great magnitude which they acquire in acute inflammations.

VI. *The Lymphatics.*

These vessels pass through the genial region in their course to the submaxillary lymphatic glands.

VII. *The Nerves.*

The superior lip is freely supplied with filaments from the sub-orbital, the buccinatorius and from the temporo-facial branch of the seventh pair. These nerves are sufficient to account for the exquisite sensibility of this lip and the severe pains which accompany its acute diseases.

VIII. *The Skeleton.*

It consists of the anterior surface of the ossa maxillaria superiora and of the corresponding dental arch as far as the dentes canini; consequently we find in it, in the middle, the symphysis, surmounted by the anterior nasal spine; a little more externally the myrtiforme fossette (*a depression for the depressor alæ nasi*); then the undulating line of the alveolæ and the external surface of the teeth. It is in this region that the superior maxillary bone presents the greatest resistance; hence the infrequency of its fractures. It is not unusual to see it split from before backwards, a little on the outer side of the median line; and sometimes there is a similar fissure on both sides; a disposition which is frequently attendant upon the simple or double hare-lip. The middle bone is then the rudiment of the os incisivum or intermaxillare of mammiferous animals, which, by anomaly of developement, was not united to those between which it is locked in the normal state. Generally, it supports the first two incisor teeth, and projects more or less forwards. In adults, especially in those in whom the three portions of the lip have never been united, it passes beyond the line of the maxillary bones; and this appears to be owing to that want of pressure which would naturally have been produced

by the upper lip in being reflected upon the bones. The mucous membrane forms a duplicature which is called the frænum of the lip, and we should not fail to divide this fold before we scarify the edges of the fissure, in the operation for hare-lip. Without this precaution, it would interrupt the passage of the scissors, so that the posterior blade of them would not extend as high as might be necessary. So with respect to the plate which is introduced between the lip and the bone, when the bistoury is employed. It is at the groove which separates the posterior surface of the superior border of the lip from the bones, that Desault has proposed penetrating into the maxillary antrum. In fact nothing is more simple: all that is necessary is to detach the mucous membrane between the root of the canine tooth and the obtuse crest which descends from the malar eminence, in order to arrive at it by penetrating a few lines higher up. In the same manner we might reach the infra-orbital nerve, if we wished to divide it by the mouth. It should be noticed, however, that it would be difficult to avoid dividing the caninus muscle (*m. lev. ang. oris*); but this inconvenience does not counterbalance the advantages obtained by preventing the formation of cicatrices on the skin, in women especially. The posterior surface of the superior lip being concave, it is necessary, if we wish to avoid a groove behind the cicatrix after the operation for the hare-lip, that the needles should be introduced in such a manner that they will pass through the raw edges of the wound at the point where the two anterior thirds of their thickness unite with the posterior third.

Inferior Lip.

This is generally a little thicker than the preceding, and more everted forwards. In the middle of its free border we observe a depression, into which the superior labial crest is received, and as we proceed from the median line this border is slightly convex, its extremities being turned downwards. From this normal disposition then, it follows that cancerous tumours, etc., may be removed by a semilunar concave flap; and that even if this flap should include all the tissues as far as the mento-labial groove, the notch which will remain after cicatrization will not be so great as

we might have expected. In fact it is not necessary that this free border should be convex in order to receive the lip above. Its natural eversion is not indispensable to its functions, for which reason, the lip, although shorter after the operation, ascends sufficiently to touch that which is above it; and, furthermore, the skin of the neck being very extensible, as the cicatrix forms it draws it upwards, and thus succeeds in elongating the lip. A great number of operations performed by MM. Dubois, Richerand, Dupuytren, etc. confirm these assertions.

The anterior surface of the lower lip has neither vertical crest nor groove, which is owing to its being formed apparently of two lateral portions only. Hence if congenital hare-lip should be met with in it, it ought to be on the median line.

The union of its free border with that of the upper lip, constitutes the labial commissures. These commissures are occasionally the seat of excoriations, ulcers, wounds, etc., which deserve strict attention, an account of the contractions of the mouth which they might occasion. With respect to wounds which extend from one of these commissures externally, they must necessarily be brought together by the twisted suture, if we wish to prevent deformity. Otherwise, in fact, the movements of the lips will prevent cicatrization. This advice is equally applicable to wounds of the eye-lids.

Constituent Parts.

They are absolutely the same with those of the upper lip; it is only in their arrangement that any difference exists, which we will now point out.

I. The Skin.

This membrane is not covered by so great a quantity of hairs; it scarcely supports more than a small pencillous cluster, which is placed in the sub-labial fossette.

II. The Adipo-cellular Tissue.

It is arranged as in the other lip, and is probably a little more abundant.

III. *The Muscles.*

They are the same as in the upper lip, unless it is that the orbicularis receives upon its convex border the extremity of the superbus, of the quadratus and depressor anguli oris, in the place of those which enter into the composition of the superior.

VI. *The Arteries.*

They are a little different. Thus the inferior coronary comes off from the facial at a more considerable distance from the commissure, and the arch which it forms with its fellow does not give off an inferior vertical branch; therefore a wound across the median line of this region will not be attended with hæmorrhage; besides, it does not approximate the free border of the lip so much as the superior coronary, unless it is in the middle. From this disposition it follows that, in dividing the lip from above downwards, we will reach the artery sooner in proportion to the distance of the incision from its origin. In order to ascertain the exact course of this vessel, it is sufficient to imagine a curve passing about three lines from the edge of the lip and terminating at the anterior and inferior part of the masseter. The lower lip also receives some twigs from the mental: a considerable branch is also given to it by the coronary itself, near its origin from the facial.

v. *The Veins and Lymphatics.*

These vessels possess the same characters as those of the chin and superior lip.

VI. *The Nerves.*

Filaments from the termination of the inferior dental, and some of those of the buccal are distributed to the deep-seated parts. The superficial twigs are derived from the cervico-facial branch of the respiratory of the face, and also from the ascending branches of the cervical plexus. In short, the lower lip is less freely supplied with nerves than the superior, and its sensibility is less acute.

VII. *The Mucous Membrane.*

It likewise forms a duplicature, which is shorter than that of the upper lip, and is attached to the maxillary symphysis. The labial glands which separate this membrane from the muscles are more numerous, larger, and their excretory duct more distinct than in the superior lip.

VIII. *The Skeleton.*

It comprises the anterior portion of the inferior alveolar arch, and the external surface of the dentes incisivi et canini.

Sect. 6. The Olfactive Region. (Vide Plate 2.)

It is composed of the whole of the interior of the nasal fossæ. The latter are limited, superiorly, by the anterior third of the base of the cranium and the internal surface of the nose properly so called; inferiorly, by the palatine arch; externally, by the zygomatic fossa, the orbit and the maxillary sinus; posteriorly, by the pharynx, and anteriorly by the opening of the nose. A vertical septum separates them from each other throughout their whole extent; but this septum frequently inclines more to one side than the other; and when this defect of symmetry is carried very far it may have effect over the sound of the voice, respiration, and induce the belief that polypi exist. This mistake has several times occurred, and surgeons, by their inconsiderate manœuvres, have destroyed the septum itself, instead of tearing out these pretended polypi. We have seen two patients consulting Prof. Bougon this present year, in whom similar attempts had been made. In both, the cartilaginous portion of the septum touched the inferior turbinated bone; and in one of them, three separate trials had been made to extract the supposed polypus, and so incautiously, that the two nasal fossæ communicated with each other through an opening into which the end of the little finger might be easily introduced.

As the nasal cavities are very complicated, we consider it best to examine them in their different parts: thus, we will shew suc-

cessively the anterior apertures, the vault, the floor, the internal and external parietes, and the posterior opening.

I. *The anterior openings of the Nostrils.*

They look more or less directly downwards, according to the degree of elevation or depression of the lobule of the nose. Their form is that of an oval, the anterior extremity of which is the smallest. The investing mucous membrane is thick, adherent, slightly coloured, and participates, for the most part, in the characters of the skin; a few hairs originate from it, which serve to catch foreign atoms which might be introduced into the nostrils. Their skeleton is formed by the cartilage with a double branch, which was pointed out, when speaking of the extremity of the nose, in the nasal region. This cartilage is enclosed, on all sides, between the skin and the mucous membrane; the posterior extremity of its internal branch does not touch the anterior nasal spine; on the contrary, this extremity turns outwards, and tends to complete the circle by approximating that of the external branch, which, on its side, is inclined inwards. It results from this arrangement that the large extremity of the anterior opening of the nose is actually situated in the upper lip, lower than the floor of the nasal fossæ: whence it follows that, in order to introduce a probe, forceps, the finger, or any foreign body whatsoever into the nose, we must first pass it obliquely upwards, to the extent of several lines, before we give it the horizontal direction; whence it follows also, that it is necessary to press up the lobule of the nose considerably, when we wish to have a view of these cavities.

II. *The Vault.*

The vault is the longest paries of the nostrils, and may be divided into three portions: the anterior, which is inclined downwards in the direction of the dorsum nasi, to which it corresponds. In this portion, which forms, in uniting itself with the septum, a groove of considerable depth, the mucous membrane is delicate and villous, but does not enclose many follicles: this membrane is less adherent here than in the opening which has

just been examined; polypi seldom originate from it; but it is frequently the seat of cancerous or sanious ulcers called *ozenæ*. The skeleton which enters into the composition of this part of the vault of the nasal fossæ, is formed, from above downwards, by a small portion of the nasal notch of the os frontis; by the posterior face of the os nasi which is inclined outwards towards the nasal process of the superior maxillary bone, which produces the groove pointed out above; by the internal surface of the triangular cartilage, and of that of the free extremity of the nose. It should be remarked that where the nasal gutter terminates under the latter, there is a species of *cul-de-sac*, which renders the lobule much thinner than we would suppose it to be from an external examination of it simply: therefore, when we extirpate or canterize its cancerous excrescences, we must avoid penetrating too deeply, lest we occasion an opening into the cavity of the nose, which would remain fistulous. There is at present a case of this kind in the Hospital of *la Faculté*, in a woman seventy years of age. A cancerous ulcer was situated on the left side of the lobule of the nose. The disorganised structure was extirpated and the arsenical paste applied. The woman was cured, but an opening remains between the lobule and ala nasi.

It is between the ala nasi and the mucous membrane that the vessels and nerves coming from the orbit are placed. A considerable branch of artery and of vein pass through the bone near its middle, in their way to the lobule, or remain upon the dorsum of the organ, producing habitual redness of it in some individuals, from the varicose state of the capillaries of the venous branch. The active circulation in the arterial branch also explains the bright colour which is manifested in the same parts during the process of certain diseases; which colour generally indicates an epistaxis, and which guided Galen in forming his celebrated prognosis. The naso-lobar nerve is imbedded in a small furrow which conducts it to the inferior border of the bone, where a slight notch permits it to pass upon the external surface of the cartilages.

From what has preceded we see that this part of the superior paries is very solid, and so constructed that it opposes great resistance to such foreign agents as would tend to depress, or fracture it, etc.

The second, or middle portion, is horizontal, and corresponds to the ethmoidal fossa of the cranium. It is only two or three lines in breadth. The mucous membrane, in this situation, is thick, soft and villous: the cribrated lamina of the ethmoid, and, posteriorly, a very small portion of the wings of *Ingrassias* form the skeleton of it. As these osseous plates are very thin and fragile, foreign bodies driven with a certain force into the nose, may penetrate the cavity of the cranium, and cause instant death by lacerating the brain. It is at this part that wounds are most dangerous; and even when their effects do not extend to the cranial box, they will at least pervert the sense of smell, by the injury which they inflict upon the expansion of the olfactory nerve in the *Schneiderian* membrane. It is at the place where this portion of the vault unites with the preceding that we find, by the sides of the crista galli, the small fissure of the cribriform plate which gives passage to the ethmoidal twig of the ophthalmic nerve and artery from the cranium into the nose.

The frequency of disease in this portion of the nostrils, the tenuity of the bones, and the caries with which they are sometimes attacked in inveterate cases of syphilis, as well as its anatomical relations with the cranium, explain in what manner those herniæ of the brain, of which M. Boyer has spoken, may penetrate into the cavity of the nose.

The third, or most remote portion, corresponds to the Sella Turcica: it is inclined downwards and backwards. The mucous membrane is a little more dense at this point, is continuous with that of the vault of the pharynx, and contains some follicles. The skeleton is formed by a prolongation of the orbitar process of the os palati, the superior portion of the vomer, which, together with the body of the sphenoid bone, constitutes a small canal, through which the pterygo-palatine artery and nerve run; more anteriorly, by the body of the sphenoid still, and the (*cornets*) ossa turbinata of Bertin. Here we find an irregular opening, which varies in its dimensions and leads into the sinuses of the sphenoid. If we could readily detect the diseases of these sinuses, we might easily penetrate into them, as we shall see, when we come to speak of the external paries. We are induced to believe, for several reasons, that the disagreeable odour which exhales from certain individuals, is owing to ulceration of the

membrane which lines these cavities, the capacity of which varies, and which, all other things being equal, is augmented in proportion to the advancement of age. It is generally in this part of the vault that the force of blows received upon the vertex of the head are concentrated; but as the bone is spongy and very thick it is rarely fractured.

III. *The Internal Parietes.*

They are formed by the faces of the septum. The pituitary membrane which covers it is very thick, vascular, and lined by a very strong fibrous lamina, which also exists throughout the whole extent of the nasal fossæ; but is in no part so distinct as it is in this. Although this species of periosteum is pretty firmly adherent to the septum, yet it is less so than to the mucous tunic. In addition to the internal nervous branches of the first paries, which are distributed between these two laminæ, we also find the naso-palatine nerve similarly interposed. The septum is formed by the whole of the vomer; more anteriorly and superiorly, by the perpendicular plate of the ethmoid; and quite anteriorly, by the cartilage of the septum. To these we must also add superiorly the crest of the sphenoid, which is embraced by the separation of the plates of the vomer; the nasal spine of the os frontis resting upon the ethmoidal plate, and, inferiorly, the species of crest which exists at the junction of the superior maxillary and palate bones with each other. The two nasal spines form the anterior and posterior extremities of the inferior border of the septum. As all these parts are thin and fragile, the introduction of the finger or instruments into the nose requires great caution, in order to avoid making a communication between the two nasal cavities, which would occasion more or less derangement in the sense of smell and the sound of the voice. The pressure of polypi upon this septum may also produce a perforation of it; and we have seen several examples in which this state of parts was congenital.

IV. *The Inferior Parietes or Floor.*

This paries is formed by the superior surface of the palatine

arch, and is about two inches in length, or three, if prolonged to the apex of the nose. It is regularly concave in its transverse direction; plane from before backwards, and gently inclined towards the pharynx; its anterior border is raised a little, which should be remembered when we wish to probe the nasal canal.

Its *schneiderian* membrane possesses the same characters as upon the septum; but it receives a much smaller quantity of nerves, and is rarely the seat of polypi: syphilitic and cancerous ulcers, however, are frequently observed in it.

The palatine process of the superior maxillary bone, and the horizontal portion of the os palati, constitute the skeleton of this paries; consequently, we see upon it a transverse suture which unites these two bones; and sometimes there is a second, anteriorly, which indicates the persistence of the os intermaxillare. The latter has been observed in man by Vesalius,* Columbus,† etc., and more recently by M. Lobstein. It is the separation of this anormal suture which so frequently co-exists with the double or single hare lip; between it, or the situation which it occupies when it does exist, and the septum, close to the anterior border, we observe the nasal aperture of the naso-palatine canal, through which the naso-palatine nerve passes, in order to enter the ganglion of the same name. This aperture is closed by the mucous membrane, and can only be seen upon the denuded bones.

v. *The External Paries.*

This is the most complicated and most important. Inferiorly, it is quite as extensive as the preceding, longer in the middle of its height, and shorter at its most superior part. The mucous membrane which appertains to it is thicker, redder, and more vascular than elsewhere; only it becomes more delicate and attenuated where it penetrates the accessory cavities, or rather its fibrous lining then abandons it. Upon the free border of each turbinated bone, it forms a fold which seems to give to these shells greater breadth, and prolongs them further anteriorly and posteriorly. It adheres very firmly to the skeleton; and, as it is abundantly supplied with vessels, but a very slight conges-

* De Fabric: corporis humani, etc.

† De re anatomicâ, etc. lib. 1er.

tion is necessary to produce epistaxis: hence the frequency of this hæmorrhage. The irregularities of the surfaces which it is obliged to cover, are probably the principal cause of the engorgements, tumours, and diseases of different natures which so frequently occur in it. We should be upon our guard against the bulging out of the folds which it forms upon the borders of the *ossa turbinata*, because they have more than once been mistaken for polypi, and wrenched out as such; more than once, also, they have been torn in seeking for these excrescences which did not exist, and unreflecting surgeons have mistaken the flaps, thus violently formed, for portions of these tumours which they have been determined to find. This membrane also diminishes the greater proportion of those apertures which we are about to examine; but in no part of it do fleshy fibres exist.

In the summit of, and little towards the posterior part of this paries, we find a short and shallow groove, which is separated from the vault by a small crest, into which enters what Gavard calls the *square plate of the ethmoid*. This groove does not lead to any important cavity. More inferiorly, we see the superior turbinated bone of Morgagni, which terminates, anteriorly, towards the middle of the length of the paries. The gutter which this bone circumscribes is broader and more superficial at its posterior than at its anterior part. In the first direction it leads to two openings; a superior, which communicates with the posterior ethmoidal cells and the sphenoidal sinus, into which we might easily penetrate by passing a stylet above the middle turbinated bone, along the external paries of the superior meatus, provided that, when the extremity of the instrument gets near the termination of this gutter, we elevate it a little as we pass it backwards. The other is inferior and situated upon the external paries: it leads directly into the pterygo-maxillary and zygomatic fossæ. Through this opening, the spheno-palatine vessels and nerves enter the nose. Polypi may also pass from the nasal fossæ through this aperture into the zygomatic fossa, and be prolonged into the substance of the cheek anterior to the masseter. In 1824, we saw a remarkable example of this kind in a young man ætat. 20, who continued a long time in the hospital of the *Ecole de Médecine*. This opening is situated just below the posterior extremity of the superior turbinated bone, and a probe,

having its extremity slightly curved, might be easily introduced into it : anteriorly, the meatus terminates upon a plane surface, which presents nothing remarkable.

Below this, we find the ethmoidal or middle turbinated bone, which is prolonged in a pointed form near to the pharyngeal opening of the nostrils ; the anterior extremity of this bone is raised a little, and terminates four or five lines from the os nasi. Hence it follows that it is more prominent, and consequently that the middle meatus is deeper in the centre than towards its two extremities. This meatus is much wider anteriorly than posteriorly. In it we meet with two openings which are worthy of attention ; one of which is higher than the other, and is situated under the anterior extremity of this turbinated bone ; a small excavation leads to it from behind forwards, from below upwards, and from within outwards : this is the inferior orifice of the anterior ethmoidal cells, or of the *Infundibulum* by which we penetrate into the frontal sinus. It is by this communication that worms, etc. have made their way from the nose into the frontal sinus, deceiving some persons with respect to their real origin. It is the cause why wounds of the frontal sinus with loss of substance generally remain fistulous ; it enables morbid fluids secreted in the nose to pass between the plates of the os frontis, and, on the other hand, polypi, pus, etc., to descend from the sinus into the nasal fossæ. It would also be possible to throw up injections through this opening, if they should be deemed useful.

The other aperture is situated towards the middle of the length of the meatus, a little higher than the inferior border of the turbinated bone, about an inch and a half from the anterior nasal opening. In this place the nasal gutter is excavated, on which account the aperture in question looks slightly downwards and inwards : so that, if we wish to pass an instrument into it, we must direct it from below upwards and from within outwards. In the dead subject this little operation is, in this way, very easy to perform. But, if the instrument is at first carried too high or too far back, we will meet with many difficulties, and it is doubtless owing to this circumstance that surgeons have abandoned this operation, so highly recommended by Jourdin and Alouelle. The mucous membrane which covers the border of this opening is thick, and forms a circular fold, in which there are

a great number of large follicles, considered by some anatomists as one gland. This fold, like those which envelope the loose margins of the turbinated bones, is susceptible of becoming turgid, and thereby closing the entrance into the antrum of *Hygmore*; but it does not form either a valve, or sphincter which might obstruct the passage into this cavity. The antrum *Highmorianum*, or maxillary sinus, is a very important part of the face; its figure is pyramidal; its superior paries forms the floor of the orbit, and it is in this wall that we find the infra-orbital vessels and nerve. The anterior paries corresponds to the canine fossa, and includes the anterior and superior dental nerves of the infra-orbital branch: the rupture, laceration or any lésion whatsoever of these nerves may, to a certain extent, explain the very serious symptoms which sometimes follow the extraction of the dens canina. We have noticed that Desault perforated this wall in order to expose the sinus.

The inferior paries rests upon the alveoli of the molar teeth, and is sometimes perforated by the root of these organs. The third or fourth molar tooth approximates nearest to the maxillary cavity, and it is by their alveoli that we prefer perforating this cavity; especially, as by this means, the artificial opening will correspond to the most dependent point, and will thereby favour the escape of pus, or any other foreign body which we may desire to extract. It is also in consequence of the relations of the molares with the antrum *Highmorianum* that fistulæ sometimes follow the extraction of these teeth. The posterior paries is rounded and concave; it encloses the nervous filaments which pass to the roots of the molar teeth, and corresponds to the zygomatic fossa; the summit is prolonged into the malar eminence, and is there so near the surface that some surgeons have considered it the best place for applying the trephine, and Lamorier, among others, advised perforating the maxillary sinus below the os malæ. The base is the largest paries of this cavity, and corresponds to the whole extent of the middle meatus; it is perforated in its centre by the aperture just spoken of, a little nearer its superior part, however, than its inferior. From this arrangement we may comprehend why pus, or other fluids accumulated in the sinus, will escape more readily through an artificial opening in the alveoli or lower part of

the canine fossa, than by the natural aperture which exists in the nose.

Besides these, the middle meatus presents nothing remarkable except at its posterior part, where it leads to the Eustachian tube.

Next to this meatus is the inferior, or maxillary turbinated bone, which is the largest and longest, terminating in an elongated point where it approximates the pharyngeal opening, and in a fold slightly inclined downwards towards the facial aperture of the nostrils. The free margin of this bone is sometimes three, four, and even five lines from the floor and external paries of the nasal fossæ; at other times, on the contrary, it lies so close to them, that the inferior meatus is converted into a complete canal. We also find all the intermediate degrees, whence arises the various results obtained by different surgeons, in their attempts to penetrate into the nasal duct, as recommended by *Bianchi*, *Laforest*, etc. Nevertheless, this operation does not seem to deserve that oblivion into which it has fallen, and as some surgeons of celebrity, among whom is M. Gensoul, of Lyons, are again attempting to bring it into vogue, by advising us to act upon the nasal duct, in cases of tumour or fistula lachrymalis, in the same manner as we operate upon the canal of the urethra, in cases of stricture, according to the method of Ducamp; we think that we must devote a few moments to the investigation of the anatomical disposition of the inferior meatus. It is a gutter, forming the three fourths of a canal, which corresponds externally, and from behind forwards, to the vertical portion of the os palati, to the internal surface of the nasal portion of the superior maxillary bone; that is to say, to the inferior fourth of the base of the maxillary sinus; and lastly to the inferior groove of the ascending process of the maxillary bone. Superiorly, it is formed by the concave surface of the inferior turbinated bone, and inferiorly, by the external part of the floor of the nasal fossæ. The nasal duct opens into this meatus at the junction of its external and internal parietes, but in such a manner, that it extends a line and a half further upon this latter; i. e. it is cut obliquely at the expense of the turbinate, and looks inwards, and a little backwards; hence it follows, that we must also give this direction to the slope of the canula, when we operate for fistula lachrymalis according to the method of Foubert; and in the same manner, when we introduce the probe.

we must elevate its extremity from behind forwards, and from within outwards. The orifice of this canal is situated about six lines from the nasal aperture, and we do not think that this distance is so variable as Morgagni, and some others since his time, have asserted. In fact, in one hundred heads, M. Vesigne* found but very trifling variations; and from what has come under our own observation, these differences are so slight, that they could not prevent the easy introduction of an instrument into the nasal duct. It is bounded anteriorly by a prominence which is formed by the posterior margin of the base of the ascending process; superiorly, under the inferior turbinate, this prominence is separated from the orifice of the nasal canal by a species of cal-de-sac, into which the probe may be insinuated, and thereby occasion the principal obstacle to its introduction. Another cause of difficulty arises from the instrument not being sufficiently curved: in fact, it is necessary to bend its extremity at more than a right angle with the handle; unless this is done, it will strike against the posterior paries of the duct, and penetrate the maxillary sinus, if much force is exerted. The reason of this peculiarity is found in the direction of the duct itself, which runs obliquely upwards, forwards, and very slightly outwards, and especially in the membrane which contracts this aperture. This fold is so disposed, that the orifice by which it ascends into the canal, is nearer the posterior than the anterior semi-circle of this osseous canal.

In short, we think that it would generally be easy, by recollecting the anatomical peculiarities which have just been detailed, together with a little habit, to introduce into the nasal canal, by the inferior meatus, probes, bougies, stylets, with the view of throwing injections into it, removing its obstructions, cauterising it, etc.

It is also by the inferior meatus, that a probe may be passed from the nose to the pharynx, in order to introduce it into the *Eustachian* tube; but we must then be careful not to elevate the instrument too much, as it would be liable to fracture the turbinated bone. It is with the view of avoiding this inconvenience, that, in attempting to apply a ligature around polypi, or plugging the nasal fossæ, it is much better to pass the instruments upon the

* Thèse, 1824.

inferior paries, between the floor and os spongiosum, than to slide them along the meatus itself.

The bones which enter into the composition of the external wall of the nasal cavities, are remarkable only for their greater or less degree of fragility. Thus, posteriorly, the skeleton is pretty solid, because it is formed by the internal surface of the pterygoid process and the posterior parts of the superior maxillary bones, upon which the vertical portion of the ossa palati rest. In the middle part, it is extremely brittle, because it there consists only of the thin plates of the ethmoid and the internal paries of the nasal sinus, which are very slender and very fragile. Therefore, operations performed in this point, almost always occasion the destruction of these osseous laminae. Anteriorly, the solidity is considerable, as it is there constituted by the nasal process of the superior maxillary bone. It is proper to remark, before concluding, that if this fragility of the bones has its inconveniences in most cases, there are, nevertheless, some in which it may prove advantageous. For example, it is on account of the tenuity of the os unguis, that we are advised to establish through it an artificial course for the tears, either by following the method of Wolhouse, or by adopting that of Hunter, of Scarpa, etc. We know that the object of all these operations is to cause the nasal canal to communicate with the inferior part of the middle meatus, and that Hunter recommended the application of a plate of ebony between the superior and middle ossa turbinata, in order to serve as a point of support for his perforator. With respect to this plate, the disposition of the parts is such that we do not think that it would be impossible to make use of it, if we wished to resort to the method of the English surgeon. At least, we think that this question requires still further examination.

VI. *The posterior opening of the Nasal Fossæ.*

This opening is double, and formed by the termination of the four parietes. Its figure is that of an oblong square placed vertically; it is a little broader below than above; its perpendicular diameter measures about an inch; its transverse inferior diameter only six lines. These diameters should be kept in mind when we are obliged to introduce the finger, plugs, etc., from the pha-

rynix into the nose, in order that the greatest breadth of the foreign bodies may correspond with the greatest diameters of the openings through which they are to be passed.

A few observations remain to be made upon the vessels and nerves of the nostrils.

A. *The Arteries.*

They come from the internal maxillary, through the pterygo-palatine foramen; from the ethmoidal twigs of the ophthalmic; from the coronary of the facial, etc. They are quite small, and of very little surgical importance; but where they ramify in the mucous membrane, they become very superficial, which disposes them to hæmorrhage.

B. *The Veins.*

One collateral vein accompanies each artery, which it surpasses in volume; but there is an additional one which communicates with the apex of the longitudinal sinus by the foramen cœcum, and others which pass into the coronary sinus, through the pores of the sphenoid, etc. Vicq. d'Azyr thought that the latter might explain the active hæmorrhages which occur in cerebral diseases. These small veins always connect the circulation of the nasal fossæ with that of the encephalon.

C. *The Lymphatics.*

They have not been satisfactorily traced.

D. *The Nerves.*

These organs proceed from the first pair which is entirely distributed to this region; also from the fifth which gives numerous branches to it from the sphenopalatine ganglion, ophthalmic branch, etc. According to the recent experiments of Magendie, the filaments of the first preside over the sense of smell; those of the fifth, on the contrary, over the general sensibility.

Sect. 10. Buccal Cavity or Region. (See plate 2.)

It is circumscribed anteriorly and laterally by the internal surface of the two alveolar arches ; posteriorly, by the pharynx ; superiorly, by the nasal fossæ, and inferiorly by the plane of the border of the lower jaw. It forms a cavity which is naturally filled by the tongue, when the jaws are in contact. If we consider the tongue as removed, this cavity is from eighteen to twenty-one lines in height in the middle, and a few lines less anteriorly and posteriorly. We will now examine it successively superiorly, laterally, inferiorly and posteriorly.

The Palatine Vault.

This part forms the superior paries, and is inclined upon the sides and anteriorly, becoming continuous with the dental arches : it is very concave and continuous posteriorly with the velum palati.

CONSTITUENT PARTS.

I. The Mucous Membrane.

The mucous tissue is dense, compact, slightly coloured, non-villous and presents many very hard transverse wrinkles, especially anteriorly, but becomes softer and of a redder colour posteriorly. It is covered by a very distinct *epithelium*, which is elevated in a considerable number of diseases. In consequence of the compact texture of this membrane it is but seldom diseased.

II. The Sub-mucous Tissue.

This is a very strong and almost inextensible fibro-cellular lamina, which answers the purpose of a periosteum to the bones, and of a lamellated envelope to the mucous membrane ; that is to say, that its superficial surface is filamentous and less compact than its deep surface. The cryptæ are situated upon the former of these surfaces, between it and the mucous membrane. This tissue sometimes gives origin to extremely hard fibrous bodies,

which seldom acquire, however, a large volume. It adheres very firmly to the bones, especially at the sutures.

III. *The Arteries.*

They enter this region through the posterior palatine foramina ; their principal branch follows the contour of the vault, first between the fibrous tissue and the bones, then between the fibrous and mucous membranes. If one of these branches should become aneurismatic, an example of which has been observed by M. Delabarre, it would be very difficult to treat the disease otherwise than by the actual cautery ; for the inequality of the bones and the firmness of the parts would oppose the application of compression or the ligature.

IV. *The Veins.*

They have the same arrangement as the arteries.

V. *The Lymphatics.*

Our knowledge of them is imperfect, but they present nothing remarkable.

VI. *The Nerves.*

They all come from the spheno-palatine ganglion, but by two different routes ; first, the superior palatine nerve which descends along the canal of this name in order to meet with the artery, and follows its course into the palatine vault : next, the naso-palatine, which goes to form the ganglion of the same name in the anterior palatine foramen. This ganglion, discovered by MM. Jacobson and H. Cloquet, afterwards gives off a pencil of filaments which are distributed to the palatine membrane behind the incisores teeth.

VII. *The Skeleton.*

We find in it the palatine process of the superior maxillary

bone and the horizontal portion of the os palati. These four osseous pieces are connected together by a crucial suture, and their point of junction, upon the median line, exists at the union of the two anterior thirds with the posterior third of the vault. These bones are frequently attacked with caries or necrosis in the venereal disease, which frequently occasions a communication between the nose and mouth. These accidental openings may be made to disappear by means of (*obturators*) metallic plates suitably adapted to the deficiency of the parts, nevertheless, they have more or less effect over the tone of the voice. Sometimes the median suture of this osseous vault is wanting: then the separation is prolonged backwards, without being carried forwards to the lips; and in this case there is a division of the velum palati. In other cases the separation is continued forwards, without being extended backwards to the pharynx, which may be attended with one of two different species of malconformation; either the median fissure bifurcates, and includes between the two branches of this bifurcation the inter-maxillary bone, which generally coincides with a double hare-lip; or there is no bifurcation, but the fissure does not arrive at the superior lip by following the median line; it runs obliquely forwards and outwards and corresponds with the simple hare-lip. Finally, it is possible for the palatine fissure to extend from one extremity of the vault to the other.

But an anomaly still more singular may exist. In a male subject, of about forty or fifty years, which was brought into the pavillions of the *Ecole-pratique*, there was neither horizontal portion of the os palati, nor palatine process of the os maxillare; the palatine membrane was twice its natural thickness, and as hard as fibro-cartilage; that of the floor of the nostrils was in the same state; they were separated from each other by a space of a line and a half, which was filled with a kind of mucus, forming a cavity intermediate to the palatine vault and the floor of the nasal fossæ.

The Circumference of the Buccal Cavity.

It presents for consideration only the internal part of the gums, in which we find the same elements as in the vault; except that they are thicker, more vascular, and of a much less compact tex-

ture than the palatine membrane ; which accounts for their being more frequently subject to disease. In becoming continuous with the mucous membrane of the superior paries of the mouth, the gums block up, anteriorly and posteriorly, the inferior aperture of the palatine canals ; so that these foramina only exist, properly speaking, in the skeleton.

The internal surface of the teeth forms, anteriorly, a groove, the depth of which is proportionate to the degree in which these small bones are inclined towards the lips. Posteriorly, between the anterior pillar of the velum palati and the last molares, there is a small space which will admit the extremity of the little finger, and which generally corresponds to the internal surface of the coronoid process, or rather, to its anterior margin : by means of this space the buccal cavity communicates with the large grooves which separate the lips and cheeks from the external surface of the dental arches. When the mucous membrane of the cheeks, tongue, etc., is inflamed and swollen, it sometimes insinuates itself into this space, and is thereby painfully compressed and even wounded during mastication, in consequence of advancing between the teeth. A foreign body, or any instrument whatsoever, might penetrate through this opening into the cavity of the mouth or pharynx, notwithstanding the jaws are firmly closed, and wound the organs contained within them. In many persons, we also observe other small spaces between the teeth, which produce that undulated appearance remarked on the borders of the tongue, when it is the seat of inflammation.

We may also remark, that the internal paries of the alveolæ becomes almost immediately blended with the palatine process, and is shorter and stronger than the external. This peculiarity seems to indicate that in applying the fulcrum of Garengéot's key upon the palatine side of the alveolæ, we will be less liable to fracture the walls of these cavities, in extracting the teeth, than if we should apply it upon the outer side : the point of support, would, in fact, be more solid ; and as the fangs of these teeth are naturally a little curved, they would be extracted with less effort.

The Inferior Parietis.

This parietis is continuous with the supra-hyoideal region, and has no skeleton. In the middle of it is the tongue, which fills the mouth when it is closed. The superior surface of the tongue is free throughout its whole extent, and is prolonged by the isthmus of the throat, to the epiglottis. This surface is convex, from before backwards, and even transversely; however, it presents a slight depression upon the median line. Of its inferior surface, the two posterior thirds of the distance from the epiglottis to the tip is adherent: it is at this part that it receives the muscles, vessels, nerves, etc. Its anterior third is free, or fixed only by a membranous fold behind the symphysis of the chin. It is this fold or frænum, which, when too short, prevents infants at the breast from protruding the tongue and performing suction properly; whence the indication of dividing it. When, on the contrary, it is too long, J. L. Petit and some others, have supposed that it would permit the tongue to slide backwards upon the palatine vault into the pharynx and occasion suffocation. But if these apprehensions are not chimerical, they are at least exaggerated. The posterior extremity of the tongue is fixed to the os hyoides which participates in most of its movements, and which connects the function of speech with those of deglutition and respiration.

COMPONENT PARTS OF THE TONGUE.

I. *Its Membranous Envelope.*

Upon the dorsal surface it is very thick, and studded with a great number of small eminences called papillæ. At its posterior part, these papillæ are broad, flattened, and perforated in their centre: they are perfect cryptæ, organs of secretion, and are collected around the excavation called "*foramen cæcum.*" In the middle, as well as at the tip and margins, where the membrane is much more delicate, these papillæ become conical or fungiform; they are then small, erectile, and form the organs of sensation. The examination of these corpuscles merits the greatest attention in acute diseases, and is not without importance in chronic

affections. The shades of their colour and their degree of prominence, afford innumerable varieties in the different derangements of health; but, in general, we may say that if they are pale and but slightly developed, if the tongue is smooth and more or less loaded, the organs of digestion, and the stomach in particular, will bear evacuant remedies without danger, provided they are otherwise indicated; whereas, if they are red, and raised upon the mucous membrane, if they appear tender, we must use them with great caution. In consequence of the compact texture of this membrane upon the dorsum of the tongue, and its slight extensibility, chaps frequently manifest themselves in it, and the tumours which we observe in it are almost always hard and of small volume. At its most posterior part, it becomes attenuated, and forms three folds, two lateral, which envelope the glossal pillars of the velum palati; and one central, which unites the tongue to the epiglottis. On its inferior surface it is thin, supple, slightly adherent, and of a brownish colour, a tint which is owing to the transparency of the ranine veins, which it immediately covers. In reflecting itself upon the inferior paries of the mouth, the mucous membrane forms a species of fringed crest, in which there are some adipose vesicles. Where this crest unites with that of the opposite side, near the frænum, we find the orifice of the duct of Wharton: the small ducts of the sublingual gland open a little farther back.

II. *The Cellular Tissue.*

It is supple, very delicate, and sends off an infinite number of processes between the fleshy fibres. It is to the laxity of the cellular element that we must attribute the rapidity with which the tongue sometimes tumefies, and the enormous volume which it may acquire.

III. *The Muscular or Proper Tissue.*

This tissue is composed of very delicate fibres, which intersect each other in various directions, but are principally directed from before backwards. From the latter circumstance our incisions should be longitudinal, and when cancerous tumours are removed from the end of the tongue, they should be included in a trian-

gular flap, having its base situated anteriorly, in order that we may afterwards be able to bring the two sides of the division parallel to the direction of the muscular fibres. These fibres are derived from the lingualis, genio-glossus, hyo-glossus, stylo-glossus, and several other muscles, with which MM. Bauer, Blandin, et Gerdy, have recently been advantageously occupied.

iv. *The Arteries.*

The tongue is very liberally supplied with arteries by the external carotid; but there are three only which merit particular attention, viz: the dorsalis linguæ, palatina inferior, which are distributed to the neighbourhood of the tonsils and the tissue of these organs, and the ranina artery especially. This last passes through the inferior portion of this organ, and is at first situated deep between the hyo-glossus, genio-glossus and lingualis muscles; but as it approximates the tip it becomes very superficial, being almost solely covered by the mucous membrane; on this account it is very much exposed to the action of the instrument in dividing the frænum linguæ in children. It is for the purpose of avoiding its division, in these cases, that we should direct the point of the scissors downwards instead of upwards. Furthermore, this branch is so large that it will occasion a troublesome hæmorrhage, and on account of its tortuous course, the softness and mobility of the tissues which envelope it, it will retract very considerably when divided and thereby become difficult to secure. And on the other hand, the natural humidity of the parts, by opposing the astringent action of the air upon the divided tissues will also render the hæmorrhage more serious. It follows, then, from this combination of circumstances, that the actual cautery, or compression with the forceps, *un valet patina* etc. are the only means which art can employ when the ranine arteries are wounded.

v. *The Veins.*

These are more numerous and larger than the arteries, and

* A species of forceps joined in the middle with a screw (*volsella patini*).
Transl.

communicate directly with those of the amygdalæ and pharynx ; which explains the advantageous results which the ancients derived from bleeding from the ranine vein in angina and other diseases of the throat. They form a net work, which is principally observed at the inferior surface of the tongue ; and it is in the free portion of this surface, immediately below the mucous membrane, that these veins collecting form the ranine. This last vein lies more superficially and more externally than the artery, and as it is of considerable size, it might, if opened, produce a rapid and beneficial *degorgement* in diseases of the mouth in general, and of the tongue in particular ; but its relations to the artery must be attended to. When we divide it, it is better to dip the point of the lancet obliquely backwards and upwards, and at the same time incline it rather outwards than inwards. This disposition of the venous system also indicates that it is more rational, in acute swellings and other diseases of the tongue requiring scarifications, to make them upon the sides of the inferior surface of the tongue than upon the dorsal surface. It is well to remark, however, that the quantity of blood which follows these incisions is not always sufficient to account for the sudden and sometimes surprising relief which they produce. In 1818, there was a patient in the general hospital of Tours afflicted with an enormous swelling of the spleen and daily vomiting. About five or six o'clock one evening he felt, without any appreciable cause, his tongue begin to swell ; at eight o'clock the tumefaction was considerable, suffocation imminent, and the tongue protruding from the mouth. Being on the watch, we were called, and made two incisions with the lancet, and although not more than two table-spoonsful of blood were evacuated, the tongue, on the day following, was reduced to its natural size.

vi. *The Lymphatics.*

They pass to the submaxillary and cervical lymphatic glands.

vii. *The Nerves.*

These are numerous, and are derived from three branches ; the glosso-pharyngeal appertains principally to the base of the

tongue, and its filaments may be traced even to the lenticular papillæ; the lingual branch of the fifth pair (*n. gustatorius*) ramifies freely in the muscular fibres, and terminates in the conical and fungiforme papillæ; the ninth pair (hypo-glossal) is lost in the muscles. It is in consequence of these anatomical views that the latter nerve has long been considered as appertaining to motion, and the two former to the sense of taste and the general sensibility. Some experiments had already been tried in order to resolve this question, which only gave contradictory results; but the recent researches of M. Magendie upon the trifacial nerve, have manifestly proved the above to be the fact. From this difference in the action of the nerves of the tongue we will perceive the reason why the taste sometimes persists in persons affected with paralysis of this organ, and why the gustative function is at other times destroyed notwithstanding the movements of the tongue are free. We also find several branches from the great sympathetic, following the principal vessels, and distributed to the base of the tongue; and it is by means of these filaments that it participates with the functions of the interior life.

VIII. *The Skeleton.*

In man the tongue does not present any skeleton, but we find in its centre, upon the median line, a fibro-cartilage, placed vertically, (*placé de champ*),* which is prolonged backwards towards the epiglottis. This plate, sometimes indistinct, gives attachment to some fleshy fibres which enter into the composition of the muscles of this organ, and forms the only solid part of it.

Under the mucous membrane, between the tongue and the inferior maxillary bone, we find the sublingual gland anteriorly, and a prolongation of the submaxillary gland posteriorly. These two organs form in this situation an elongated eminence, which is liable to vary considerably; but it should be remarked that the lymphatic glands sometimes become prominent here in consequence of tumefaction, and may be mistaken for a disease of the salivary glands. If the former should be affected with cancer or any other disease requiring extirpation, we should commence by detaching it from the side of the bone, at the same time raising

* Blandin, *Archives*, 1823.

it with a hook; it will then be very easily removed without incurring any risk, provided the instrument does not glance towards the ranine and sublingual arteries. When the duct of the submaxillary gland dilates in such a manner as to form *ranula*, this tumour, being supported externally by the jaw, pushes the tongue upwards, and may thereby contract the isthmus of the throat to such a degree as to endanger suffocation. A remarkable example of this kind is related by Burns. "A man called to consult Mr. Cline on account of a tumour which had existed for a long time under the tongue, and, while waiting in an adjoining room, Mr. C. heard the noise of a fall and stifled groans. He immediately enters and finds the man lying on the floor and on the point of suffocation. Suspecting the cause to be a foreign body lodged in the trachea, he is about to perform the operation for bronchotomy, when he perceives that the tongue of the patient is forced backward by a large ranula, which is also projecting out of the mouth. He introduces the lancet and gives vent to a large quantity of pus and lymph."

As these tumours, when growing, remove the nerves and vessels of the tongue to a considerable distance, a very extensive part of them may be excised without danger.

According to Marochetti, the pustules, which the Greek peasants and even physicians, among others Dr. Xanthos, say are developed under the tongue, from the third to the ninth day after the bite of a rabid animal, would be situated in the tubercle where the excretory ducts of the sublingual and submaxillary glands terminate. These pustules, then, in the opinion of this surgeon, must be merely a dilatation of the extremities of these canals, in consequence of an accumulation of the rabid virus within them. If this opinion should be confirmed, and if we could be so fortunate as to prevent the development of hydrophobia by the extirpation of these pustules, the operation would neither be difficult nor dangerous; for the anatomical relations of the parts are such that we might penetrate to a sufficient depth in this situation, without incurring any risk of wounding the arteries. Nevertheless, we think it would be better to seize the vesicle with a hook or forceps, and remove it with the curved scissors, than to make use of the scalpel or bistoury.

The Isthmus of the Throat.

This opening is formed, inferiorly, by the dorsal surface of the tongue; superiorly, by the velum and velum pendulum palati; and laterally, by the pillars of the velum.

The velum palati is a prolongation of all the soft tissues of the superior paries of the mouth and inferior of the nasal fossæ, and also includes a certain number of muscles which determine its movements. We consequently find in it, in the first place, a thick, slightly extensible, and lacerable mucous membrane, which is generally of a deeper colour than that of the interior of the nose and mouth, and lined by a layer of filamentous and dense cellular tissue, in which there are a great number of very large follicles; next, another lamellated membrane, which unites the latter to the muscles. It is in the first of these tissues that purulent and œdematous infiltrations, etc., are developed, and these are the follicles which appear to be the principal seat of disease in the various affections of the velum palati. In these laminae the principal nerves and vessels ramify; but they are unimportant in a surgical point of view. It is proper to observe, however, that it is very liberally supplied with venous capillaries; which perhaps will enable us to explain the prompt and beneficial results which some surgeons derive from touching the mucous membrane with the nitrate of silver in certain inflammations.

A man was suddenly attacked with a very acute pain in the upper part of the mouth, and, on inspection, we perceived a reddish blue spot, of the size of a two franc piece, upon the anterior surface of the velum palati, the rest of the throat being in its natural state. We touched this spot with the nitrate of silver: one hour afterwards the pain had ceased, and on the day following the redness had disappeared.

Next, the muscles: these are, the levatores palati, which draw the velum towards the nasal fossæ; the tensores palati, which widen it by drawing it horizontally, in consequence of their being reflected over the hook of the pterygoid process, forming a pulley; the palato-pharyngæus and constrictor isthmi faucium, which depress it towards the base of the tongue; lastly, the levator uvulæ, which appertains especially to the uvula. As all

these muscles, with the exception of the *azygos uvulæ*, lie upon the sides, we may easily explain how the separation which exists between the two halves of the *velum palati*, when this organ is divided, is produced; but it is not so easy to account for their spontaneous approximation, in some convulsive actions of the pharynx, as is frequently observed, for example, when the *staphyloraphy* is performed. We had an opportunity of observing this phenomenon very distinctly, in a female operated upon in June by M. Roux. We in fact saw, and M. Roux directed our attention to it several times, the two lips of the division pass towards each other and come into contact, whilst this skilful surgeon was attempting to lay hold of them with the forceps or tenaculum. This fact is not satisfactorily explained to us by the known laws of muscular contraction.

The *velum*, like the vault of the palate, seems to be formed by the approximation of the two lateral parts. Now, if this approximation is not effected, a congenital division will be the result, which may exist alone, and thus form a species of hare-lip in the back part of the mouth; or it may be accompanied with a more or less extensive separation of the palatine suture, which being prolonged forwards, may coincide with a single or double hare-lip. It is for the purpose of removing this infirmity, heretofore considered as incurable, that M. Roux invented the *staphyloraphy*. This operation, simple and easy in itself, but delicate and tedious on account of the depth of the organs upon which it is necessary to act, has already been performed by the celebrated surgeon of *la Charité* about twenty times; and if not always with complete success, at least with a sensible amelioration in such cases as would not admit of a perfect reunion. At first view, we might apprehend that the sutures would cut through the soft parts which they must embrace; but observation has shown that this does not happen; and this may be accounted for by the compact texture of the mucous membrane, and especially of its cellular tissue, which is almost fibrous; by that of the *circumflexus palati*, which becomes aponeurotic in this situation; and lastly, by that of the *azygos uvulæ*, the entire body of which is comprised within the loop of the ligature. When the attachment of the *velum palati* to the posterior margin of the vault participates in the malformation, it may hinder the re-union of

the soft parts: in such a case, M. Roux makes a transverse incision, and separates this membrane on each side, by carrying it along the posterior border of the floor of the nostrils; after which there is no obstacle to the approximation of the scarified edges of the wound. This operation is, without contradiction, one of the most brilliant conquests of the surgery of the nineteenth century.

The free margin of the velum palati is prolonged in its middle by a conical eminence, the length of which varies considerably. This small body which is indirectly attached to the posterior spine of the nasal fossæ, is called uvula, and does not exist in animals, unless it is the ape, in which it is very small. It contains the same elements as the velum palati, and its figure is moulded upon the azygos uvulæ muscle, which retracts and partly elevates it. The mucous membrane forms the greater portion of it; indeed, with the follicles, it constitutes the whole of the inferior half of its free portion. These follicles are so large and numerous that they form a thick layer which gives to the uvula a very distinct glandular appearance. M. Lisfranc says that there are three in particular at the extremity of this organ, which are very large. It is to their swelling, to the inflammation of the cellular tissue which envelopes them, or to serous effusions into the laminae of the mucous membrane, that what is vulgarly called the falling down of the palate is to be attributed. Of whatsoever nature this elongation may be, it occasions much inconvenience, and a troublesome cough, in consequence of the irritation which it keeps up in the throat by titillating the tongue. In all these cases, if it is not indurated, or of very long standing, cauterizing it with the nitrate of silver will seldom fail to cure. But should this means prove unsuccessful, we must resort to excision as the only resource which holds out a chance of success. For this purpose the scissors invented by Percy, having one of its blades a little longer than the other, and bent towards the end transversely, so as to prevent the organ slipping from between the blades, are very serviceable; or we may seize the end of the uvula with a hook or forceps, and then snip it off with a blunt pair of scissors. When the tumefaction of the uvula is very great, the greater part of it may be removed without inconvenience. Surgeons have frequently supposed that

they have cut it off at its root, when only that portion of it which is below the azygos was actually removed, and the congestion of the tissues being relieved by the operation, they resume their regular position; and the uvula then appearing almost of its natural length, some have supposed that it was regenerated.

Upon each side of the uvula, the border of the *velum palati* forms an arch which bifurcates in descending, in order to form the pillars, and thus constitute the lateral parts of the pharyngeal isthmus. The anterior branch or pillar includes the *glosso-pharyngæus* muscle and is lost upon the side of the tongue; the posterior descends into the lateral paries of the pharynx, and seems to go to attach itself to the body of the *os hyoides*: this encloses the *palato-pharyngæus* muscle. These two pillars consequently leave between them a triangular space, the base of which is below, and in which the tonsils are situated. These last organs are composed of a great number of mucous follicles, intimately adherent to the mucous membrane, which also sends numerous processes between them, uniting them to each other. The *amygdalæ* are subject to two species of inflammation; that is to say, the inflammatory state may be developed in the surface of the mucous tissue, which generally produces factitious membranes of different species, which may be mistaken for ulcers and even gangrene; or the inter-follicular and sub-mucous cellular tissue may be the principal seat of the inflammation. In the latter case, phlegmonous abscesses are disposed to form, and when they frequently recur they may occasion induration. As the use of the knife is frequently required in inflammations of the tonsils and their consequences, it is necessary to know the exact relations of this gland, especially its external part. It is, in fact, in this situation that it is approximated to the internal carotid artery, from which it is separated, in the natural state, only by the constrictor of the pharynx, some cellular tissue, nervous filaments and a complicated venous plexus. In general, the artery is eight or ten lines behind and external to the gland; so that in plunging the bistoury between the pillars of the *velum palati*, it would be easier to strike this vessel when the tonsil is in a state of tumefaction, as it is then carried near to the artery. In order to avoid this terrible accident, which must almost inevitably be mortal, it would be better to direct the point of the instrument more towards the

pharynx, than towards the ramus of the jaw. Notwithstanding Burns relates one example, M. Portal a second, and Béclard a third, this accident must be very rare, and can only happen to those who, by distraction or some other cause, have entirely forgotten the anatomy of the posterior fauces. In the extirpation of this gland when scirrhus, there is still less risk, because the organ being drawn forwards by the forceps, it is scarcely possible, in cutting it out with the scissors or bistoury, to dip so deep as the artery. But it must not be forgotten that, during this operation, the velum palati, the pillars and tongue are alternately elevated and depressed, so that the gland appears prominent at one moment and at the next depressed: hence the advantage of using the scissors, for although the probe-pointed bistoury may be conducted by a dexterous hand, it will be liable to wound other organs unnecessarily. The hæmorrhage which follows this operation is sometimes considerable, and proceeds from the very complex net-work which is formed in the tonsil by the superior and inferior palatine arteries, and to the tonsillary circle which results from their anastomoses being of considerable volume. But more frequently the blood is discharged from numerous large veins, which form a species of plexus externally and against the posterior wall of the pharynx.

It is in the same depression in which the tonsils are lodged, and upon the tonsils themselves, that syphilitic ulcers of the throat are generally developed; it is also upon these organs that croupal concretions begin to form in the greater proportion of such cases; therefore these parts should be closely inspected when we have the least suspicion of these diseases.

Sect. 11. Pharyngeal Region or Cavity.

Broader in the middle than at its extremities, it seems formed of two cones joined at their base, the superior of which is curved forwards in order to become continuous with the nasal fossæ, whilst the inferior descends almost perpendicularly.

We will consider the pharynx anteriorly, posteriorly, laterally, superiorly, and inferiorly.

1. *The Anterior Part.*

This is the most complicated part, and presents, from above downwards, first, the posterior opening of the nostrils, the superior and inferior parietes of which incline considerably downwards in order to enter the pharynx, forming a curve and not a right angle. In consequence of this disposition, matters which are rejected from the stomach easily enter the nose, when the velum palati is drawn down, and, on the other hand, sounds or other foreign bodies, readily descend into the pharynx, when they have passed through the nasal fossæ.

2. The posterior surface of the velum palati and of the uvula. It is important to remark that this part prolongs the palatine vault an inch and a half backwards : whence it follows that the secretions which come from the nasal fossæ into the posterior fauces fall behind the larynx, and are thereby removed from the respiratory passages ; and that it is difficult to introduce tubes into the larynx through the nose ; whereas, by this route, it is much easier to pass them into the stomach, than by introducing them through the mouth.

3. The posterior buccal aperture, which we have examined in the preceding region. This opening is so disposed that it leads very obliquely downwards into the pharynx, or rather that it seems to continue the latter cavity upwards and forwards ; for which reason, when the aliment is formed into a ball upon the base of the tongue, it is carried by its own weight into the pharynx, as soon as the isthmus faucium no longer opposes it. This anatomical disposition also explains why substances ejected from the stomach have a greater tendency to pass out by the mouth than the nose, and so much the more so, as the velum palati being prolonged into the pharynx, these substances as they ascend from the stomach, strike against its inferior surface, and thus almost mechanically apply it behind the nasal fossæ.

4. The posterior face of the larynx and its epiglottic aperture. In the middle of this portion we observe an eminence which corresponds to the cricoid and arythenoid cartilages, an eminence more strongly marked, but also narrower superiorly than inferiorly. Upon the sides of this species of crest, we distinguish two

deep gutters, especially in repassing towards the mouth, in which they are gradually lost after having passed over the sides of the epiglottis. Owing to these gutters and the eminence which separates them, liquids, as they descend into the œsophagus, are naturally divided into two columns; which would prevent them from entering the larynx, even if the epiglottis did not exist.* They are circumscribed laterally by the internal surface of the thyroid cartilage, lined by its villous membrane. The laryngeal opening is a fissure about nine or ten lines in length, and from a line and a half to three lines only in breadth; broader towards the arythenoid cartilages than anteriorly, and having its posterior extremity a little more depressed than the anterior; so that it looks upwards and slightly backwards. It is surmounted by the epiglottis, which forms a species of valve connected to the larynx by a pedicle in the retiring angle of the thyroid cartilage, and upon the sides by the arytheno-epiglottic ligaments. The position of this cartilaginous plate is such that it does not actually shut the chink of the air-tube except during deglutition, and when it is necessary to retain a great quantity of air in the lungs, as, for example, in the act of supporting heavy burdens, etc.†: otherwise it is raised almost perpendicularly; so that its anterior surface looks towards the superior dental arch, whilst its inferior face regards the bottom of the posterior paries of the pharynx. From this it follows that, during expiration, the air is propelled into the upper and back part of the latter cavity, above the velum palati, and that its natural exit is through the nostrils. Hence also, in order that the epiglottis should fall during deglutition, the base of the tongue must be elevated. Consequently, when we wish to introduce a tube into the glottis for the purpose of establishing respiration, as in still born children, or to resuscitate persons in the state of asphyxia, we must commence by depressing the posterior extremity of the tongue: without this precaution the instrument will generally penetrate into the pharynx. For this reason also we are less sure of introducing a canula into the larynx when we pass it along the median line, than when we slide it upon the sides of the base of the tongue. Furthermore, it is ea-

* Magendie.

† M. Isidore Bourdon, *Recherches sur le mecanisme de la respiration, etc.*, Paris, 1820.

sier to perform this operation by the mouth, because when the instrument is introduced through the nose it will strike against the posterior paries of the pharynx, rendering it difficult to pass it into the larynx without hooking the extremity of the instrument with the finger carried deep into the throat.

II. *The Posterior Wall.*

It has no striking peculiarities, excepting that its mucous membrane is very thick, especially superiorly, and contains numerous very large sebaceous follicles, which very frequently become the seat of ulceration and inflammation. The fleshy layer of this wall comprehends the three constrictor muscles, and presents the following relations: superiorly it is separated from the atlas and dentatus and their ligaments by the insertions of the rectus capitis anticus major and minor; in descending, it is only separated from the forepart of the other cervical vertebræ, upon the median line, by the ligamentum commune anterius, and laterally or before the transverse processes, by the rectus capitis anticus major and the longus colli. There is not, therefore, any organ behind this wall which it would be dangerous to wound; and for this reason certain jugglers introduce bars of iron, etc., of a considerable weight into their throats with impunity; the extremity of the metallic rod which is in the pharynx, rests upon the anterior part of the vertebræ, and the jaws maintain the equilibrium. The posterior wall of the pharynx is united to the above-mentioned organs by means of a very lax and very extensible lamellated cellular tissue, in which one of the branches of the inferior pharyngeal artery ramifies; also veins of a larger size and much more numerous, which unite and separate several times in order to form a plexus, their trunks finally terminating in the interal jugular vein; lastly, some filaments of the glosso-pharyngeal, par vagum and great sympathetic nerves.

III. *The Lateral Walls.*

In their upper part we meet with the *Eustachian* tube, which is expanded in the form of a funnel, and consists of a fibro-cartilage which forms two-thirds or three-fourths of a canal completed

by the mucous membrane, which envelopes besides the whole of the cartilaginous extremity in the pharyngeal cavity, and also lines its internal surface, extending to the ear. This canal is situated some lines behind the middle meatus of the nasal fossæ, and the notched portion of the cartilage looks forwards and upwards. Between the root of the pterygoid process and the basilar apophysis, there is a *cul-de-sac* or excavation, into which the extremity of the probe might be readily insinuated in attempting to introduce it into the tube by the middle meatus. In fact, if, when the end of the instrument gets into the pharynx, it is raised in the least degree above what is necessary, and if it does not fall exactly into the guttural canal of the tympanum, it will almost always enter this excavation : a circumstance which requires some notice, because injections are frequently thrown into this place instead of the natural canal. In order to avoid this mistake, it is preferable to introduce the probe by the inferior meatus, because when it has once got behind the extremity of the inferior turbinated bone, it will only be necessary to raise the end of it a little outwards for it to slide almost of its own accord into the place required ; and this is occasioned by the levator palati muscle, which, as it descends in the velum palati, represents a column directed obliquely from above downwards, from behind forwards and from without inwards. This muscle, the pterygoid process, and the tensor palati circumscribe a triangle with a superior base, in which the eustachian tube is enclosed ; so that when the instrument gets as far as the posterior part of the meatus or of the floor of the nasal fossæ, it is precisely in the summit of this triangle. Then, by tracing the gutter which it represents, to its upper part, it will enter directly into the tube ; we must be careful, however, not to pass it beyond the fleshy pillar, as it would then be difficult to find the opening we are in search of. It is also proper to observe that the membranous duplicature which envelopes the inferior turbinated bone, is generally lost in the superior paries of the guttural duct of the ear ; which renders the operation extremely easy, by attending to the preceding directions. Furthermore, we should bear in mind that this duct is directed outwards, backwards and slightly upwards, therefore we should give to the tubes, with which we penetrate into it to any

depth, whether for the purpose of breaking down obstructions, or conveying injections, but a very gentle curvature.

The posterior pillar of the velum palati forms a second column which descends backwards and outwards into the lateral wall of the pharynx. Lower down, this paries gradually becomes narrower, and no longer presents any thing of importance. The characters of its mucous membrane are the same as in the preceding wall; its follicles and villosities are abundant, and it is gen- of a pretty deep colour.

Its muscles are the three constrictors and the stylo-pharyngæus; the stylo-hyoidæus, palato-pharyngæus and the levator palati also form a part of it.

This wall corresponds to the parotideal region, and is consequently coasted by the primitive carotid inferiorly; a little higher by the two branches into which this trunk divides; still higher by the internal carotid, and throughout its whole extent by the jugular vein which lies upon the external surface of the arteries, and which places itself quite behind, resting a little on the outer side of the anterior cerebral artery previous to its entrance into the foramen lacerum posterius; by the glosso-pharyngeal nerve which is partly lost in it; by the superior cervical ganglion, its numerous filaments and the par vagum which are behind and between the vessels, as well as by the spinal accessory in the superior part only; finally, by the ninth pair, and more remotely by the styloid process, the muscles which originate from it, the parotid gland and the external carotid artery. It is sufficient to mention these relations in order to show the danger and severity of wounds of this side of the pharynx, especially such as are produced by balls, and pointed or cutting instruments; and they also point out the necessity of proceeding with the greatest circumspection when performing operations in this situation.

iv. *The Superior Extremity or Vault of the Pharynx.*

This extremity is merely the continuation of the posterior wall which bends considerably forwards in order to become continuous with the vault of the nostrils. This disposition is at least evident with regard to the mucous membrane, which is softer, thicker and redder in this place than in the rest of the organ. The

superior constrictor muscle is attached very near the sphenoid, upon the basillary process, and is separated more than an inch from the foramen magnum occipitale by the anterior recti capitis muscles. In consequence of this disposition the velum palati, when rising, soon comes in contact with the vault, or superior part of the posterior wall of the pharynx which is inclined forwards, whereby it is not necessary for this velum to be applied directly against the whole of the pharyngeal opening of the nasal fossæ during deglutition, vomiting, etc. The skeleton which we find above the soft parts appertains to the base of the cranium; it is composed of the basillary process and of a part of the occipitopetrous sutures. The principal bone being spongy and very thick, the encephalon is found sufficiently protected in this situation. But it is at the posterior part of this paries, or, if we prefer it, in the commencement of the posterior wall, that we find the occipito-atloidien articulation; and as there is a considerable space between the os occipitis and anterior arch of the atlas which is filled by ligaments only, a small sword, or other instrument, entering the pharynx and passing in an oblique direction upwards and backwards, might, without great difficulty, penetrate the spinal canal, or cranium, and divide the medulla oblongata.

v. *The Inferior Extremity.*

It becomes considerably narrower and terminates, on a level with the cricoid cartilage, in becoming continuous with the œsophagus. It is on account of the narrowness of this opening that foreign bodies, of a certain magnitude, are frequently stopped in it. It should be observed that the tissues composing the pharynx here undergo a change of character: thus the lining membrane which, in the cavity just examined, was red and filled with follicles, has suddenly become pale and almost smooth. We might, perhaps, in this difference of structure, find the reason why the accidental membrane, which is formed in *diphtherite*, or pellicular inflammation,* terminates abruptly at the commencement of

* It is thus that M. Bretonneau designates certain affections hitherto known by the name of croup, angina maligna, etc., and upon which he is about to give a very important work to the public.

the œsophagus, in most subjects. The muscular fibres, which were transverse, suddenly take a perpendicular direction, and this canal then separates entirely from the larynx.

CHAPTER II.

OF THE NECK.

THE neck is that narrow part of the body which is situated between the head and thorax, and which varies in length according to the degree of *embonpoint* and constitution of the individual. In some it is very short and thick, in others the reverse. In the first case, if not owing entirely to *embonpoint*, it generally indicates an apoplectic disposition; and a long slender neck is often observed in those who are predisposed to phthisis. We divide it into anterior and posterior portions.

ART. I. ANTERIOR PORTION OF THE NECK.

This part comprehends all the organs situated before the cervical vertebræ. Upon its surface we observe, in the course of the median line; inferiorly, the supra-sternal fossette; and above this the laryngeal eminence; more externally, another oblique eminence, which passes from the sternum behind the ear, and which is more strongly marked when the head is turned to one side and inclined towards the shoulder: this is the sterno-mastoid ridge. The supra-sternal fossette is prolonged between this ridge and the laryngeal eminence into the parotideal region, and thus forms a gutter on each side, which is broad and pretty deep superiorly, superficial and almost indistinct in the middle, and becoming united and blended with each other in the supra-sternal fossette. On the outer side of the sterno-mastoid ridge, we see the supra-clavicular fossa, bounded posteriorly by the trapezius.

This portion of the neck is thus naturally divided into three regions: first, a superior which we call submaxillary, supra-hyoidean or sublingual region; secondly, an inferior and median, or infra-hyoidean; and lastly, the supra-clavicular, which is inferior and lateral.

Sect. 1. Supra-Hyoidean Region.

It is bounded ; superiorly, by the base of the lower jaw and the floor of the mouth ; a little more posteriorly, by the parotideal region ; inferiorly, by the os hyoides and its cornea arbitrarily prolonged to the sterno-mastoid muscle ; laterally, by the anterior margin of this muscle. Broadest in the middle, it afterwards gradually becomes narrower, in order to terminate in a point upon the sides. From before backwards and from above downwards it forms an oblique plane, which rises or sinks in accordance with the motions of the tongue or larynx. In some individuals it forms a very distinct semilunar prominence, which is separated from the jaw by a groove of greater or less depth ; this is called the double chin. Posteriorly, at its entrance into the parotideal excavation, it becomes more concave.

CONSTITUENT PARTS.

I. The Skin.

In women and children this is thin, delicate, and very extensible, whilst in man it is thicker, on account of giving support to the beard ; it often contains transverse wrinkles which are not effaced by any position of the head, and which are produced by the contractions of the platysma muscle. Its follicles are more numerous and of larger size than in the other regions of the neck, but less so than in the face ; and pustular eruptions, etc., are of more frequent occurrence here than in the other regions. It is very vascular, and is frequently the seat of *navi materni*, and erectile tumours.

II. The Subcutaneous Layer.

It is composed of three laminæ :

The first is formed by a compact filamentous cellular tissue, enclosing adipose cells, which are usually very fine, but may become quite large, in which case they form the submental prominence previously spoken of. This cellular lamina unites the

platysma intimately with the skin, so that when this muscle contracts, it always draws with it the cutaneous envelope, and for this reason also, whenever we nip up a portion of the latter, the subcutaneous muscle is comprised in the gripe. Finally, from this arrangement of structure, we readily comprehend why tumours developed in this tissue are always spherical, prominent, and seldom acquire a large size before they perforate the integuments.

The second lamina is constituted by the platysma itself. Its fibres, sometimes very thick, at others scarcely distinct, ascend obliquely forwards and inwards, in order to enter the regions of the face, or to attach themselves to the inferior border of the jaw; so that they leave between them, upon the median line, a small triangular space, the apex of which is at the chin: these are the fibres which produce the wrinkles above mentioned.

The third is formed by a lamellated cellular tissue, destitute of adipose cells, which unites the platysma to the cervical aponeurosis. This lamina is but loosely united to the aponeurosis, upon which it slides with facility, but adheres more firmly to the platysma and follows its movements. Beneath it the anterior jugular veins are found, and, posteriorly, a small portion of the external jugular. In consequence of its loose and lamellated texture its inflammations frequently assume the phlegmonous character, and pus readily collects in it in the form of abscess; but for the same reason also, this fluid may easily penetrate downwards, and detach the parts to a very considerable extent. Therefore, these abscesses should be opened as soon as fluctuation is evident, and in dividing the platysma the incision should pass parallel to its fibres. It is well to notice also that these abscesses, as well as all other tumours developed in this layer, may become very large without disorganising the skin, and yet retain considerable mobility. This peculiarity may be very useful in establishing the diagnosis of certain diseases of the supra-hyoidean region.

III. *The Aponeurosis.*

This is a simple cellular layer in some subjects, but in others it is of a very distinct fibrous texture. This fascia originates posteriorly, from the parotideal and masseteric aponeurosis; an-

teriorly, it is attached to the base of the lower jaw ; as it descends below the chin it is thin at first, but receives a very strong lamina from the anterior belly of the digastric before it becomes blended with the *fascia cervicalis* upon the os hyoides. Laterally and posteriorly, it splits in order to envelope the submaxillary gland : then it is its anterior sheet only which descends into the supra-hyoideal region ; the posterior forms in the first place a sheath for the gland and its duct, to the prolongation which it sends between the mylo-hyoideus and hyo-glossus muscles, to the sublingual gland even, and is finally lost in the inferior paries of the mouth ; this sheet then gives off less compact laminæ which are insinuated between the muscles of the tongue.

The study of this aponeurosis is important, especially on account of the differences which it produces in the development of diseases situated between its external surface and the skin, and those which form behind or beneath it. For abscesses, or fluids collected in the latter direction, are much disposed to take their course towards the mouth or pharynx, on account of the resistance which they meet with anteriorly, and are, besides, with difficulty detected by the fluctuation, which may be obscure for a long time, notwithstanding the accumulation may be considerable. The same may be said of other tumours, as they generally acquire a great magnitude towards the deep seated parts before they render the surface prominent. The surgeon should therefore recollect all these particulars, when he wishes to open the one, or extirpate the others. This aponeurosis forms a lamellated web in which the direction of the fibres is not very distinct ; on which account it is easily resolved into cellular tissue, and is subject to so much variety in point of thickness.

iv. *The Muscles.*

Some are appropriated to the movements of the larynx and lower jaw ; the others appertain more exclusively to the tongue.

The former are :—The anterior belly of the digastric, which ascends obliquely from the os hyoides to the submental fossettes. In contact internally with its fellow of the opposite side, covered anteriorly by the aponeurosis, and concealing behind it a portion of the mylo-hyoideus, this muscular bundle forms an inverted arch

and is found separated from the *os maxillare inferius* by a space which is constantly varying during the elevation or depression of the larynx or jaw. This space is always filled by the submaxillary gland. The posterior belly of the digastricus, in descending from the parotideal region, is situated between the facial artery which is on its outer side, and the ninth pair of nerves, the lingual artery and sometimes the facial vein, which are on its inner side.

The stylo-hyoideus as it approximates the great cornu of the *os hyoides*, has the same vascular and nervous relations as the digastricus. This small muscle presents nothing very remarkable in a surgical point of view; it bifurcates in order to give passage to the tendon of the preceding, gives off an expansion to the cervical aponeurosis, and is inserted into the bone.

The mylo-hyoideus is covered by the digastricus, by a portion of the submaxillary gland, by some lymphatic glands, by the submental artery and some cellular tissue. Superiorly, it is separated from the buccal membrane by the sublingual gland, the mylo-hyoidean nerve, some laminated tissue and adipose vesicles; internally, it is kept from being in direct contact with the genio-glossus and hyo-glossus by a prolongation of the submaxillary gland, its duct, the ninth pair of nerves, the gustatory, and the lingual artery; but at its most anterior part it touches the genio-hyoideus, a thin layer of lamellated cellular tissue only intervening.

The genio-hyoideus forms a small column which descends from a rough protuberance within the arch of the jaw upon the body of the *os hyoides*, and seems to be merely the most inferior bundle of the genio-glossus.

The latter are:—The hyo-glossus, which is perforated by the lingual artery obliquely from without inwards, from below-upwards, and from behind forwards, some lines above its attachment to the *os hyoides*; so that the vessel covers a small portion of the external surface of the muscle posteriorly, whilst it is afterwards covered by the internal surface of the latter. This muscle is separated from the aponeurosis and jaw by the termination of the stylo-hyoideus muscle, the tendon of the digastricus, the ninth pair of nerves, a great part of the submaxillary gland, the facial artery and veins, some lymphatic glands and the gustatory nerve; anteriorly and superiorly, by a small portion of the sublingual gland

and of the mylo-hyoideus. All these parts are lodged in a triangular space, the internal side of which is formed by the muscle, the superior by the jaw, and the inferior by the aponeurosis. This space is lost posteriorly in the parotideal region; anteriorly, it is prolonged towards the tongue between the mylo-hyoideus and genio-glossus. Its internal surface is separated from the genio-glossus only by the lingual and sublingual arteries inferiorly and anteriorly, and by the lingualis muscle superiorly. As the hyo-glossus muscle is not attached to the maxillary bone, its relations are not altered by the amputation of the jaw.

The stylo-glossus is a small bundle which is expanded behind the preceding, and is interposed between the internal jugular vein and internal carotid artery, and the nerves which come out at the foramen lacerum posterius, situated internally; the external carotid, the facial and lingual arteries and veins, the ninth pair of nerves and the gustatory, externally. In the latter direction it is also covered by the submaxillary gland or a prolongation of the parotid.

The genio-glossus, which is the largest and most important muscle, is attached by its extremity to the rough protuberance within the arch of the lower jaw. Its fibres diverge in the form of a fan, and terminate throughout the whole extent of the inferior surface of the tongue. It is separated from its fellow by a thin cellular layer only; anteriorly, it rests upon the genio-hyoideus, and is covered externally by the sublingual gland, which separates it from the mylo-hyoideus, by the lingual artery, the ninth pair and gustatory nerves, and the hyo-glossus muscle; besides, quite superiorly, by the lingualis muscle which separates it posteriorly from the preceding. As the principal action of the genio-glossus is to bring the base of the tongue forwards during deglutition, whilst at the same time it raises the larynx by drawing it in the same direction, it follows that these movements, after the amputation of the jaw, may be interrupted; a circumstance which constitutes the chief obstacle to the complete success of this operation. In fact, after the removal of the chin, this muscle has no longer any fixed point; consequently the pharynx can no longer be distended in its antero-posterior direction, because the tongue and larynx are then merely elevated and depressed without being carried forwards. Deglutition is thereby rendered very

difficult, if not impossible, unless assisted by artificial means ; and notwithstanding the jaw may have been removed with all necessary dexterity, and the operation, as such, has perfectly succeeded, the patient has only exchanged a dangerous, perhaps mortal disease, for an infirmity which is also capable of conducting him to the tomb. These remarks, which have also been made by Professor Richerand, are unfortunately too true, for we have seen several individuals perish from this cause. One of these was a man fifty years of age, who was admitted into the hospital of St. Louis with an enormous cancer of the jaw. It was amputated by M. Richerand just posterior to the mental foramina ; the two ends were slightly approximated, and cellular granulations filled up their interval which were soon converted into a fibrous substance ; at the end of three weeks every thing appeared as favourable as possible, and the cicatrix seemed solid ; soups were given to the patient, but he could not make them pass towards the pharynx, so that it became necessary to inject them into this cavity. He became gradually exhausted, and at length died six weeks after the operation, as much from inanition as from the suffocation produced by the thick saliva and mucus which accumulated in the posterior fauces in consequence of the immobility of the tongue. From this fact we may conclude that the amputation of the anterior part of the inferior maxillary bone is a very serious operation, and that it should never be performed unless its necessity is positive, and even then it should be avoided if the disease extends beyond the depressor anguli oris. Nevertheless, M. Dupuytren appears to have obtained complete success in a considerable number of cases ; which ought to encourage surgeons. This, however, can only be explained by admitting that the portion of bone removed was but small, and that during cicatrization the divided extremities of the genio-glossi and genio-hyoidei muscles became agglutinated to the posterior surface of the new chin.*

The lingualis muscle was noticed when treating of the tongue.

* Since this article was written we have seen M. Dupuytren perform this section of the jaw in a very remarkable case. The disease obliged this surgeon to saw off the bone as far back as its ascending branches. A month has elapsed since this operation and the patient is almost cured. In consequence of this fact we must modify the opinion which we have just expressed in relation to this operation ; but

v. *The Arteries.*

Posteriorly, we find *a small portion of the two carotids.* The external is the outer side of the internal, and is crossed on this side by the digastric and stylo-hyoideus muscles, the ninth pair of nerves, and covered by the parotid gland and aponeurosis; behind this artery we see the internal jugular vein, the anastomotic branches of the great sympathetic nerve and of the first cervical pair; internally, it is separated from the internal carotid by the inferior pharyngeal artery, the stylo-glossus and stylo-pharyngæus muscles.

The relations of the internal carotid artery are the same here as were pointed out in the pharyngeal and parotideal regions.

The *facial* or *external maxillary* traverses this region in the direction of a line drawn from the posterior extremity of the great cornu of the os hyoides to the anterior part of the masseter. In this track it is tortuous and is covered by the digastricus and stylo-hyoideus muscles, the facial vein and especially the sub-maxillary gland, in the posterior and internal part of which it is sometimes imbedded; more externally, by the aponeurosis, platysma and skin; also by several lymphatic glands; internally, it rests upon the stylo-pharyngæus, constrictor medius and hyo-glossus muscles, previous to its curving over the border of the jaw. Beneath this bone it gives off the sub-mental, which runs along the attachment of the mylo-hyoideus, and passes between this muscle and the anterior belly of the digastric, in order to anastomose with its fellow of the opposite side. This is the only branch which must necessarily be divided in the amputation of the anterior portion of the lower jaw, and it seldom occasions a troublesome hæmorrhage; should it, it may be readily tied. Previous to giving off the submental, the facial artery distributes several very large branches to the substance of the submaxillary gland, which render the extirpation of this organ difficult. Finally, still nearer its origin, this trunk sends some dorsal branches to

it requires all the skill and dexterity of M. Dupuytren in order to succeed in similar cases. We must remark, however, that M. Græfe of Berlin, one of the most celebrated surgeons in Germany, has gone still farther, and has dared to disarticulate the lower jaw, removing it *in toto*.

the tongue, others to the surrounding parts; but the latter do not deserve particular attention.

From this somewhat superficial disposition of the facial artery, we see that it may be wounded either accidentally or during operations, and especially if we attempted to remove the submaxillary gland. Consequently, it is proper to remark that it is not difficult to place a ligature around it, and we think that this should be done previous to attempting to remove tumours situated deep under the jaw, in the direction of this artery, even if they are not of large size. It may be easily discovered between the cornu of the os hyoides and the submaxillary gland, by making an incision from the latter organ to the anterior edge of the sterno-mastoid muscle, in the direction of the line indicated above. We will have to divide the skin, the platysma enveloped between its two cellular laminæ; the aponeurosis, from which the artery is separated only by some cellular tissue, and sometimes the facial vein, between the submaxillary gland and the digastric muscle.

The *lingual* artery is situated a little lower than the preceding, and on its inner side; before it passes into the hyo-glossus muscle, it is crossed by the nerve of the ninth pair. Thus far its relations with the muscles are the same as those of the facial; afterwards, as it passes between the hyo-glossus and genio-glossus muscles, it is accompanied by the ninth pair of nerves, which runs along its inferior and outer side. After having given off the sublingual, it takes the name of *ranine artery*. In its course from the os hyoides to the superior part of the hyo-glossus muscle, it sends off some small branches, among which we distinguish the inferior palatine artery, which is distributed to the tonsil, etc., and sometimes the submental, when it does not originate from the facial.

It follows from these relations, that, in order to apply a ligature upon the lingual artery, as Béclard has advised in different diseases of the tongue, and *fungus hæmatodes* especially, the incision should approximate a little nearer the horizontal line than the anterior margin of the masseter, so that if its anterior extremity was prolonged it would come out at the chin. The ligature must also be placed some lines below the submaxillary gland: then we may seize the artery, separating the nerve which crosses

it, behind the hyo-glossus; or even under this muscle, by dividing the fibres which form a very thin layer over the vessel. Finally, in order to avoid confounding this trunk with that of the facial artery, we must recollect that the latter passes above and within the submaxillary, whilst the lingual is situated lower down.

VI. *The Veins.*

These are larger, more numerous, and generally less tortuous than the arteries, the direction of which they do not exactly follow; the facial vein, especially, should be examined under these different relations. At first it is external to, then behind the artery of the same name, and afterwards separates from it as it descends, passing over the external surface of the digastric and stylo-hyoid muscles, in order to terminate in the internal jugular vein. In its course from the genial to the submaxillary region, the facial vein usually plunges under the aponeurosis; but, sometimes, on the contrary, it runs between the fascia of the neck and the platysma; in which case it forms what is called the anterior jugular, and then terminates somewhat lower down in the external jugular. Nevertheless, the anterior jugular may exist at the same time that the facial follows its habitual track.

The other veins of the region generally surround the arteries, and empty their blood into the internal jugular.

VII. *The Lymphatic Glands.*

They are very numerous: several of them are situated behind, external to, and before the carotids; others surround the submaxillary gland; there are two or three above this gland, lying upon the facial vessels; and lastly, we find some between the mylo-hyoideus muscle, the jaw, the digastricus, and the aponeurosis. As these different glands receive the lymphatics of the pharynx, of the interior of the mouth and of the face, it follows that they soon become enlarged in consequence of inflammatory affections of the gums, cheeks, tonsils, &c.; especially from such as produce morbid secretions. The examination of these organs therefore is of great importance, as it may lead us to detect diseases in the organs from which their lymphatics originate, the

existence of which we might not otherwise suspect, and may prevent us from mistaking them for other diseases which occasionally occur in their vicinity. Thus the tumefaction of those in the neighborhood of the carotids might be mistaken for aneurism; of those which surround the submaxillary gland, for an enlargement of this gland itself; and of those above it, which are bound down to the jaw by the aponeurosis, for adherent cancers, which it would be imprudent to meddle with. On this occasion, we will say, with Colles, Burns, etc. that the most part of what have been considered as extirpations of the submaxillary gland, may be set down as removals of enlarged lymphatic glands.

In October 1823, a young person, aged 20 years, was admitted into the hospital of the School of Medicine, with a very hard tumour of the size of a hen's egg under the jaw, in the situation of the submaxillary gland. The opinions respecting the seat of this tumour differed. Some thought that it was a tumefaction of one or more lymphatic glands; others, an enlargement of the submaxillary gland itself. Nevertheless, it was recommended to remove it, and Prof. Bougon performed the operation. When the disease was extirpated, a deep cavity was seen between the os maxillare and the hyo-glossus muscle, and at that moment it was believed that the salivary gland had been removed; but on further examination, it was found to be merely pushed inwards, and that the extirpated tumour consisted solely of several disorganised lymphatic glands.

VIII. *The Sub-maxillary Gland.*

This gland is enclosed in a fibrous sac, which is formed by a process of the parotideal sheath and of the posterior sheet of the aponeurosis, as heretofore described. Posteriorly, it is frequently continuous with the parotid gland: anteriorly, it bifurcates in order to embrace the posterior margin of the mylo-hyoideus muscle, and its fibrous envelope sends off a process to the glandular portion within this muscle, which forms a sheath for it and its duct, and is afterwards expanded over the sub-lingual gland. The sub-maxillary gland fills almost the whole of that prismoidal space which was pointed out when speaking of the

hyo-glossus muscle ; in fact, externally and inferiorly, it touches the aponeurosis and may be felt under the skin ; the facial vein also sometimes rests upon it in this direction. Externally and superiorly, it rests against the inner surface of the lower jaw ; and it is by this side that it receives the expansion of the mylo-hyoid nerve : internally, it is separated from the mylo-hyoideus muscle by a cellular lamina, the gustatory and lingualis nerve ; and lastly, at its posterior, internal, and superior part, we find the facial artery, which lies so close to it in some subjects, that it is, as it were, imbedded in its granulations. The lingual artery is never adherent to it, but is always found opposite to the inner surface of its inferior border, from which it is soon separated by the thickness of the hyo-glossus muscle. Limited inferiorly by the arch of the digastricus, the gland follows all the movements which this muscle communicates to the larynx ; therefore, when we wish to render it as prominent as possible, the head should be thrown backwards ; and this is the best position in which to place the patient when we wish to extirpate this organ. From what has been said when on the lymphatics, it may be inferred that we are doubtful whether this operation has ever been performed ; besides, the anatomical relations of the parts, as has been described, must render it difficult and very dangerous, unless the facial artery is previously secured ; and even then, the gustatory and lingualis nerves are very liable to be wounded. If, however, the gland alone was diseased, being as it were encysted, we think that, having tied the artery, it would be possible to extirpate it without wounding those organs which it is important should be avoided.

The Canal of Wharton (*Submaxillary duct*) is always found in that process which insinuates itself between the mylo-hyoideus and genio-glossus muscles, in order to reach the sublingual gland and the sides of the frænum. The two principal nerves of the tongue run above and below it to a certain distance. It consists of three tunics, the firmest of which is the sheath it derives from the aponeurosis. It is its dilation that constitutes *ranula*, and its relations show that, if it is true that we can remove a large portion of this tumour by the mouth without danger, it would not be the same by the submaxillary region.

IX. *The Nerves.*

They are deep-seated and superficial.

Among the former we find the *Hypoglossal* (Motor Linguae, S. Lingualis, S. Ninth pair) which is at first situated on the outer side of the external carotid artery, within and above the stylohyoid and digastric muscles, then passes below the submaxillary gland, crosses the lingual artery, and ascends upon the external surface of the hyo-glossus, to the anterior part of which it distributes numerous filaments, in order to terminate in the tongue. This trunk, which establishes a communication between the fifth and eighth pairs by means of its supra-hyoideal and glossal filaments; which in the second place forms a communication between its branches and the cervical plexus by means of the *ramus descendens noni*, might be easily exposed almost throughout its whole extent, and especially in the direction of a semi-circular line commencing at the anterior margin of the sterno-mastoid muscle, on a level with the angle of the jaw, and terminating upon the body of the os hyoides: the incision should then follow the curve which separates the inferior semi-circumference of the submaxillary gland from the digastric muscle. 2d, The Lingual branch of the trifacial (Gustatory), which descends below the mucous membrane of the mouth, above the submaxillary gland, between the superior part of the hyo-glossus muscle, to which it is very closely approximated, and the internal surface of the os maxillare, from which it is separated by the gland. Having reached the anterior portion of the hyo-glossus muscle, this nerve then perforates the genio-glossus, in order to be distributed to the papillæ. Previous to this, however, it anastomoses, on the one hand, above the secretory organ, with the mylo-hyoidean filaments of the inferior dental nerve; on the other, with the hypoglossal, and then dips into the muscular fibres, on the inner side of the salivary duct of Wharton. If it should be required to divide this nerve, we would be obliged to seek for it behind the branch of the jaw, because it would be almost impossible to expose it in the region under consideration.

At the posterior part we also find some filaments of the glosso-pharyngeal, and especially the par vagum and great sympathetic

(*ganglionnaire*) which descend behind the carotids and internal jugular.

The superficial nerves are derived from the cervical plexus and the inferior branch of the facial (*portio dura*). The former run upon the external surface of the aponeurosis; the latter are principally distributed through the cellular tissue which lines the platysma. These different filaments interosculate freely with each other, and as they are numerous and enclosed in a dense tissue, they account for the acute sensibility of the skin in this region, and for the violent pains and nervous disorders which sometimes accompany its inflammations.

x. *The Cellular Tissue.*

Between the muscles it is very delicate; under the aponeurosis, it is lamellated, and encloses adipose vesicles. The submaxillary gland also contains a considerable quantity of it, which envelopes each of its granulations between which we observe filamentous processes from its aponeurosis.

It is from this cellular tissue that the pus is secreted when inflammation is developed in this salivary organ. And the same may be observed with respect to the parotid and all glands of the same species; which is owing to the glandular tissue being apparently insusceptible of inflammation or at least of suppuration.* But this suppuration may be consecutive to swellings occurring in the submaxillary gland, in consequence of inflammation of the mucous membrane extending into the roots of its canal, a circumstance which frequently happens.

xI. *The Skeleton.*

Properly speaking there is no skeleton in the supra-hyoideal region; the only solid parts which can be made to enter into its composition are the os hyoides and the inferior half of the internal surface of the os maxillare inferius. The former, almost rudimental in man, whilst in other *vertebrés* it forms a very complicated bone, † is sometimes prolonged to the styloid process by

* Gariot, *maladies de la bouche*, etc.

† M. Geoffroy Saint Hilaire, by joining to it the styloid processes, divides this

means of the stylo-hyoid ligament, which is then ossified. It is on this account that the small cornu, which gives origin to this prolongation, usually contains several osseous granules. Such a disposition, if it was recognised, might be a good guide to the discovery of the facial and lingual arteries, etc.

Be this as it may, the os hyoides give attachment to almost all the depressors of the tongue and jaw, and levators of the larynx. Hence it follows that a wound which would divide transversely the parts above this bone, would be extremely dangerous, independent of hæmorrhage, by paralysing all the movements confided to these muscles. It is proper to observe that a wound of this nature would pass above the epiglottis, and consequently would not interfere much with respiration.

The second portion of the skeleton of this region presents the genian process (*the rough protuberance within the mental arch*), into which the genio-glossus and genio-hyoideus muscles are inserted; the sub-genian fossette, for the insertion of the digastricus; the sublingual excavation, for the gland of this name; the submaxillary fossa, which is prolonged to the angle; and more superiorly, the mylo-hyoid crest. It thus forms a solid paries, and as all the organs applied against it are supported, on the other side, by the cervical aponeurosis, it follows that, when they become tumefied, they project into the mouth rather than beneath the chin.

From what has preceded we may conclude, that wounds occurring in the sub-maxillary region will in general be more dangerous, the nearer they approximate its extremities. In fact, a pointed or cutting instrument cannot penetrate more than a few lines in this direction, without danger of wounding the facial or lingual arteries, one of the carotids, or the internal jugular vein, the ninth pair of nerves, par vagum or the great sympathetic. If carried deeper, the pharynx would be penetrated. Upon the median line, the danger is much less, since there are no large arteries in this direction.

The order of the superposition of the parts is as follows: 1st, the skin; 2d, dense cellular tissue; 3d, the platysma; 4th, lamel-

bone into eleven distinct pieces; which he thus designates: the *basi-hyal*, *uro-hyal*, *ento-hyal* for the body: the *apo-hyaux* and *cerato-hyaux* for the lesser cornua; and lastly the *glosso-hyaux* and *stylhyaux*.

lated cellular tissue, in which the superficial nerves creep; 5th, the aponeurosis; 6th, the digastricus, the stylo-hyoideus, mylo-hyoideus, sub-maxillary gland, the facial artery and vein, lymphatic glands, a small portion of the lingual artery, the submental artery and the hypoglossal nerve; 7th, the genio-glossus, the duct of Wharton, the hyo-glossus, the lingual artery, gustatory nerve, the carotids, internal jugular, and the nerves situated behind the latter vessels; 8th, the genio-glossus and tongue; 9th, and lastly, the mouth superiorly, the pharynx posteriorly and internally.

Sect. 2. Infra-Hyoidean Region. (See plate 3.)

This region is bounded, laterally, by the sterno-mastoid eminences; inferiorly, by the supra-sternal notch; and superiorly by the preceding region. It represents a pretty regular triangle with its base turned upwards. Upon the median line we may discover, by the sight or touch, from above downwards, in the first place, a horizontal semi-circular depression, which corresponds to the thyro-hyoidean membrane; next the laryngeal eminence (*pomum Adami*) formed by the thyroid cartilage, and much more prominent in the adult man than in women and children; lower down, an excavation which points out the cryco-thyroid membrane; next the prominence occasioned by the cricoid cartilage; below this a lesser eminence which indicates the upper part of the trachea, and lastly, the infra-thyroidal depression, which is deeply excavated in those who are emaciated, superficial and scarcely perceptible in those of a full habit of body.

In an adult male of middle stature, the head being slightly thrown back, the distance from the os hyoides to the sternum is six inches; from the os hyoides to the sinus of the thyroid gland, two inches and a half; from the inferior margin of this gland to the sternum, two inches and a half likewise. At the inferior part of this region the two sterno-mastoid muscles are only one inch asunder; at its upper part, three inches.

CONSTITUENT PARTS.

I. *The Skin.*

It presents the same characters as in the supra-hyoidal region ; only it is still thinner, is destitute of hairs, contains fewer sebaceous follicles, and is more extensible.

II. *The Subcutaneous Layer.*

This layer is likewise formed of three laminæ arranged in the same manner as below the jaw ; the platysma, however, leaves upon the median line a more open space, in which the two cellular sheets are so blended together that they give much greater density to the fascia, which might be called the *superficial fascia of the neck* ; and we may say, by way of anticipation, that the fascia superficialis exists upon all the regions of the body ; only it assumes in some parts fibrous appearances, whilst in others it remains cellular, according to the nature and functions of the organs which it covers. In this, for example, it is thick and unyielding upon the median line ; but upon the sides it is thin and less distinct, because its laminæ have separated in order to embrace the platysma. Finally, it is in its inner laminæ that some nervous filaments of the cervical plexus and vessels take their course, among which we distinguish the anterior jugular vein, when it exists.

III. *The Aponevrosis.*

Continuous, superiorly, with that of the preceding region, it passes externally, into the supra-clavicular region, and is attached, inferiorly, to the sternum and clavicle. Its external surface is uniform, and in contact with the fascia superficialis ; its internal or posterior surface is extremely complicated. In order that its description may be rendered more intelligible, we will examine it from above downwards in the direction of the median line, and afterwards trace it from the median line towards the sides.

From its attachment to the os hyoides, to the upper part of the thyroid gland it is single, but then splits in order to form a sac

for this organ; its two sheets afterwards approximate, forming sheaths for the thyroid veins, when they again separate, and descend to the upper part of the sternum in order to be attached, the one to the anterior, the other to the posterior surface of this bone. This latter space is filled only by a laminated tissue and some adipose cells, and the depth of the supra-sternal excavation is increased or diminished in proportion to the scarcity or abundance of these elements. Abscesses forming in this interval should be opened early, lest they make their way through the posterior lamina. This posterior lamina splits in its turn, in order to form sheaths for the thyroid vessels, and penetrates into the chest, where we will find it becoming continuous with the pericardium.

If we now trace the cervical aponeurosis from the median line to each side, we will perceive that it forms as many sheaths as there are muscles, nerves and vessels; that is to say, when it arrives near each of these organs, its laminae separate in order to envelope them. Thus, for example, we find a very distinct sheath for the sterno-hyoideus muscle; another for the sterno-thyroid; a third for the omo-hyoideus; a fourth, stronger than all the others, for the sterno-mastoid; a fifth for the carotid artery; a sixth for the internal jugular vein; in short, the great sympathetic nerve, the par vagum, thyroid arteries and external jugular receive from it their several fibrous canals. It also envelopes the trachea, passes behind the pharynx, then spreads over the anterior part of the rectus anticus capitis and longus colli muscles; over the transverse processes, to which it is attached; embraces the scalenus anticus, and becomes continuous, on the one part, with the external sheet, which joins it behind the sterno-mastoid muscle, and, on the other, with the lamellæ of the aponeurosis of the supra-clavicular region. It is doubtless owing to this lamellated disposition of the fascia cervicalis, that it has seldom been described as an aponeurosis; nevertheless, it evidently possesses a fibrous texture in a great many individuals, especially in old and thin subjects. Besides, all anatomists, as well as surgeons, have said that all the vessels, nerves and other organs which enter into the composition of the cervical region are united by a dense, extensible cellular tissue, formed of lamellæ more or less intimately adherent to each other. It is worthy of notice that fat is never deposited between the numerous laminae of this fascia, and that it is

always external to it that it accumulates in persons of a gross habit.

It is important to be acquainted with this anatomical arrangement, as it accounts for the rapidity with which abscesses form in deep-seated inflammations of the neck, and, as these inflammations almost always pervade a great extent of surface, it also explains why the pus burrows in various directions, without rendering the integuments prominent. It also teaches us that purulent or other collections should be opened as soon as their existence is positively ascertained, otherwise they will be very liable to penetrate into the thorax. As the external lamina is more unyielding than any of the deeper seated, tumours which form beneath it are disposed to take an internal rather than an external direction, and consequently may compress the trachea, œsophagus, vessels, etc., in such a manner as to produce alarming symptoms before they present any considerable volume externally. Finally, when we wish to expose any organ in this region, it is absolutely necessary to recollect the arrangement of the cervical aponeurosis.

IV. *The Muscles.*

The first which present themselves are the sterno-cleido-mastoid muscles. These muscles, the internal margin of which forms the limits of this region, require particular attention when we perform the operation for tying the carotid. It is their anterior border which serves as a guide to our incisions; and as this border is thin and flattened out in some subjects, we should keep in mind the direction of its fibres, and also recollect that it is separated from the other muscles by an aponeurotic layer of considerable thickness; for if we do not, we might fumble a long time, and divide the sterno-hyoideus and sterno-thyroideus muscles, instead of simply drawing back the sterno-mastoideus. We have frequently seen students thus perplexed, in performing operations upon the dead body.

Next come the sterno-hyoid muscles, which circumscribe an elongated triangle, the base of which is inferior. In this space we observe, under the aponeurosis, and from above downwards;—the middle of the thyro-hyoid membrane, the angle of the thy-

roid cartilage, the erico-thyroid membrane and artery, the ericoid cartilage, the union of the two lobes of the thyroid gland, the thyroid veins and the trachea. It is consequently in this triangle that *laryngotomy*, *bronchotomy*, etc., are performed. Enveloped in its sheath, the sterno-mastoid covers the inferior part of the sterno-hyoid muscle, from which it is separated by the intervention of the sterno-clavicular articulation. The rest of the external surface of the latter muscle is removed from the skin merely by the inferior thyroid veins, the aponeurosis and the subcutaneous tissue. Its use being to fix the os hyoides during the depression of the jaw and tongue, or to approximate it towards the thyroid cartilage, it should not be cut across in operations. Its inferior half only rests upon the sterno-thyroideus; it next passes beyond it towards the median line, and then immediately covers the thyroid gland, the cartilages of the larynx and the thyro-hyoid excavation.

The next muscle is the sterno-thyroideus, which is a little broader than the preceding, behind which it is placed, and, with its fellow, circumscribes another elongated triangle, with its base directed upwards. In this triangle we observe the same parts as pointed out in the former, with the addition of a portion of the sterno-hyoid muscle superiorly. The external surface of the sterno-thyroideus muscle is crossed, superiorly, by the horizontal branch of the superior thyroid artery; the anastomosis of the ramus descendens noni, and the small plexus which it gives off, pass over it inferiorly, and glide between it and the preceding muscle. This muscle rests from below upwards upon the thyroidal venous plexus and the carotid, upon the thyroid gland, its arteries, and the thyroid cartilage into which it is inserted. It also corresponds more or less remotely to the trachea, œsophagus, recurrent nerves, etc. The two sterno-thyroid muscles are about one inch asunder in the middle of the region, and this distance diminishes or increases in proportion as they approximate to the apex or the base of the triangle.

In the fourth place, we find the anterior portion of the omohyoideus, covered, at the moment it emerges from beneath the sterno-mastoid, by the anterior jugular vein and a branch of the superior thyroid artery. It is enveloped by the fascia cervicalis and is separated from the skin by some filaments of the cervical

plexus and the subcutaneous tissue ; being readily felt through the integuments in some individuals. As it ascends towards the os hyoides it crosses the internal jugular vein, the carotid, the great sympathetic, par vagum, and descendens noni, the superior thyroid artery, the thyro-hyoideus muscle, the membrane of this name, and, lastly, the muscles which have just been examined.

The omo-hyoideus assists in forming two triangles with which the surgeon should be well acquainted.

The first is superior, and is bounded superiorly by the supra-hyoidean region ; externally, by the sterno-mastoideus muscle ; inferiorly and internally, by the omo-hyoideus. In this triangle, which we call *omo-hyoidien*, we find the following organs : the internal jugular and the trunks of the lingual and facial veins, the ramus descendens noni, par vagum, superior laryngeal nerve, the great sympathetic, and about one inch of the primitive carotid ; then the origin of the external and internal carotids, that of the facial, lingual, occipital and sometimes inferior pharyngeal arteries ; the superior thyroid artery is always found in it, and may here be readily exposed and tied, as we will mention directly : finally, the hyo-thyroideus muscle, a small portion of the inferior and middle constrictors, the thyroid cartilage, its superior cornu, and the side of the hyo-thyroid membrane.

The second, we call the *omo-tracheal* triangle, which is much more extensive than the former, and bounded superiorly and externally, by the omo-hyoideus muscle, externally and inferiorly by the sterno-mastoideus, and internally by the trachea. In it we observe, the whole of the sterno-hyoid and thyroid muscles, a small portion of the thyro-hyoideus, one lobe of the thyroid gland, the arteries which are distributed to it, the sub-hyoidean veins, the plexus of the ninth pair of nerves, the side of the cricoid cartilage, of the trachea and œsophagus, the recurrent nerve, primitive carotid, inferior thyroid artery, the great sympathetic and par vagum, the internal and anterior jugulars, lastly the vertebral artery.

The hyo-thyroidei (*thyro-hyoidiens*) are the last superficial muscles which we find in this region ; they are covered by all the others, resting directly upon the thyroid cartilage, but separated considerably from the thyro-hyoid membrane. It is behind their posterior margin that the superior laryngeal nerve insinuates itself

between the os hyoides and thyroid cartilage before it penetrates into the larynx.

The longus colli and a portion of the rectus anticus capitis major, deeply situated upon the transverse processes and bodies of the cervical vertebræ, also appertain to the infra-hyoidean region. Between the former and the scaleni there is a triangle through which the vertebral artery runs in its course to the foramina of the transverse processes.

v. *The Arteries.*

They are numerous and very important, the carotid arteries especially.

The right carotid is shorter, nearer the median line, more anterior and thicker than the left; which is owing to its being given off by the brachio-cephalic trunk. This disposition affords an additional reason for not performing œsophogotomy on this side, for not applying a ligature upon the artery too near the inferior part of the neck, and for taking suitable precautions in the operation of tracheotomy. Anteriorly, the left carotid is in the first place separated from the sternal portion of the sterno-mastoid muscle by a space of about an inch in extent, which is filled with cellular tissue, fat, veins of considerable size, some descending branches of the cervical plexus, etc. On the right, this interval is less extensive, and the artery runs nearer the anterior margin of the muscle. Both of the vessels are next covered by the internal surface of this same muscle, by the posterior margin of the sterno-thyroideus, and the omo-hyoideus, which crosses them; by the ramus descendens noni, which sometimes rests upon the arterial sheath, by the thyroid gland itself, whenever it is a little developed, and indirectly by the cervical aponeurosis, the subcutaneous layer and skin. But as the sterno-mastoid muscle directs its course obliquely upwards and backwards, it consequently follows that the carotid becomes more superficial the higher it ascends and therefore more easy of access. Posteriorly, it rests upon the great sympathetic, upon the cardiac filaments of this nerve and the par vagum, which are, as it were, glued to its sheath; upon the inferior thyroid artery, opposite the omo-hyoideus muscle or a little lower down: upon the ascending cervical and vertebral arteries.

and the accompanying vein of the latter ; and lastly, immediately upon the anterior part of the base of the cervical transverse processes and of the triangle limited by the anterior scalenus and longus colli muscles.

From these relations of the carotid posteriorly it follows that it might be compressed efficaciously on the left side, whilst waiting for the application of a ligature, in case it should be opened some distance above the sternum. It should always be remembered, however, that the nerves cannot long sustain this pressure.

Externally it is coated by the par vagum, then by the jugular vein and phrenic nerve ; inferiorly by the trunk of the ascending cervical artery, by that of the inferior thyroid, the cervical plexus and the parts which constitute the supra-clavicular region. Internally, it touches, in several points, the inferior and middle constrictors of the pharynx, the trachea on the right, and the œsophagus on the left ; from which parts it is separated only by some dense and lamellated cellular tissue, the recurrent nerve, diverse filaments of the sympathetic and by the inferior thyroid artery ; so that near the sternum the two carotids are removed from each other only by the trachea, that is to say, by an interval of about an inch or eighteen lines. Superiorly, on the contrary, they are separated by the entire thickness of the larynx.

From these anatomical dispositions it follows that if we wish to cut down to the external side of the carotid artery, we can only do it in its inferior third, behind the sterno-mastoid muscle ; its anterior side, however, may be exposed throughout its whole extent. In the first direction, an instrument could not reach it without having previously divided the internal jugular vein ; in the second, on the contrary, there are no important vessels before it. Therefore, whenever we wish to apply a ligature on this artery, we should endeavor to fall upon its anterior part, and the following are the organs which the instrument must then traverse : 1st. the skin, parallel to the sterno-mastoid, but in such a manner that, at the upper part, the incision should pass on the inner side of the muscular margin, whilst at the lower part, it is better to make it a little more externally, on account of the direction of the artery : this remark, however, is strictly applicable to the left side only ; 2d. the aponeurosis, forming a double lamina before and behind this muscle, which must be drawn outwards

after the division of this fascia ; 3d. a thinner but very extensible fibrous lamina, which passes from the sterno-hyoid and thyroid muscles, as well as from the trachea, anterior to the vessels, in order to blend itself externally with the deep lamina of the sterno-mastoid muscle. In this lamina we usually find some filaments of the cervical plexus and the *descendens noni* : it is this which gives a sheath to the *omo-hyoideus*, a muscle which we are sometimes obliged to divide, and which always crosses the carotid in such a manner, that when we tie this artery in the *omo-hyoidean triangle*, we should depress it inwards, and when in the *omo-tracheal triangle*, we must draw it upwards and outwards ; in this manner we may generally dispense with cutting this small muscle across ; 4th. the sheath which the aponeurosis gives to the artery, the opening of which is one of the most delicate steps of the operation ; for if we cut too much outwards, the internal jugular vein may be wounded ; if we incise directly upon the artery, we might open this vessel itself. Nevertheless, if this sheath is not divided, we will almost inevitably include in the ligature, together with the carotid, both the *descendens noni* and the cardiac nerves, which are more or less adherent to its outer surface. For this reason, after having separated the artery from the vein, we should seize this fibrous canal upon the former with the forceps, and then make a small horizontal incision into it, in the same way as we would open a hernial sac. Afterwards it will be easy to dilate this opening as much as is necessary, by means of a director introduced between the aponeurosis and the vessel. In this manner the artery alone will be isolated, all the nerves avoided, and the consequences of the operation rendered less formidable.

Whenever we wish to secure the primitive carotid, whether for an aneurism, a wound, or any disease of its branches whatsoever, the *omo-hyoidcan triangle* is to be preferred, because it affords us the most room, and the vessels are more superficial. But when the aneurism occupies the trunk, we are obliged to place the ligature nearer the sternum ; in which case the operation is more easily performed on the right, but it is likewise more dangerous, because the proximity of the subclavian will hinder the formation of the clot in the origin of the carotid.

The common carotid divides opposite to the superior margin

of the thyroid cartilage, on a level with the inferior part of the third cervical vertebra; so that the infra-hyoidean region includes about an inch of the internal and external carotids. These two branches present the same general relations as the trunk from which they originate. The external, which might here be better called the superficial, is placed before and even a little within the internal, which is the largest and is situated upon the anterior part of the spine. A ligature ought not to be applied on these two branches so near their origin. In cases which might seem to demand it, the ligature of the common trunk should always be preferred.

Before the external carotid enters the supra-hyoidean region it generally gives off the superior thyroid, the external maxillary, the lingual and the pharyngeal arteries.

The superior thyroid is the most important in a surgical point of view. The peculiarities relative to the other branches were pointed out in the submaxillary region. This branch separates from the trunk on a level with or a little below the cornu of the os hyoides, and takes a tortuous, but generally oblique direction downwards and forwards, in order to arrive at the superior and external part of the thyroid gland. Enveloped in the deep laminæ of the fascia cervicalis, it is covered a little by the sternomastoid muscle, by some cellular tissue, the aponeurosis of the neck, the subcutaneous layer, and the skin; it is crossed by the descendens noni: posterior to it we find the superior laryngeal nerve and numerous filaments of the great sympathetic. In this tract the superior thyroid artery gives off a branch which runs along the inferior border of the os hyoides, and is distributed to the thyro-hyoid membrane: this may be wounded from attempts at suicide. It also sends off a second branch which descends behind the gland, upon the inner and anterior part of the carotideal sheath. This branch must be pressed towards the trachea, if the principal artery of the neck should be tied at this point. A third branch is the laryngeal, which runs between the constrictors and the posterior margin of the thyro-hyoideus muscle, upon the membrane of this last name, perforates it, and is lost in the larynx. Here, the thyroid artery next distributes numerous large branches to the gland, which in their turn give off a certain number of twigs, among which the crico-thyroideal in particular

deserves notice, and will be examined when we come to treat of the larynx and trachea. All these arteries ramify in the glandular tissue, inosculate with their fellows of the opposite side, with branches of the inferior thyroid, and thereby form in this organ an exuberant plexus, which may occasion profuse hæmorrhage, notwithstanding the carotids have not been wounded. Indeed, we are of opinion, without doubting the sincerity of authors who have mentioned that hæmorrhages proceeding from wounds of the internal, external, or common carotids, have been arrested without the application of ligatures, that such cases should be considered as divisions of the thyroid artery or its branches, or of the facial, lingual arteries, etc.

According to the disposition of the trunk of the superior thyroid artery, it might be readily exposed and tied, either in the direction of a line drawn from the cornu of the os hyoides to the anterior and inferior part of the thyroid cartilage, or by making an incision obliquely downwards and outwards, from the os hyoides to the sterno-mastoid muscle; or, lastly, by dividing the parts in the *omo-hyoid triangle* parallel to the sterno-mastoid muscle. In this space, in fact, the artery, before it reaches the gland, is covered only by the ramus descendens noni, some veins, the aponeurosis, and the common integuments.

We likewise find in this region two other considerable arteries; the inferior thyroid and the vertebral. The inferior thyroid is at first situated behind the common carotid and internal jugular, the par vagum and great sympathetic nerves, and before the scalenus anticus and longus colli muscles; it then ascends in a serpentine manner, behind the inferior part of each of the lobes of the thyroid gland, where it terminates in a great number of branches which anastomose with those of the opposite side, and the superior thyroid. When the left thyroid artery insinuates itself behind the carotid very low down, it may be posterior to the thoracic duct; at the same time it is nearer the œsophagus than the right. Anteriorly and externally it is crossed by the cervical branch of the lingual nerve (*descendens noni*); the inferior laryngeal nerve (*recurrent*), on the contrary, is situated internally and posteriorly. The inferior thyroid artery is almost always met with in the summit of the omo-tracheal triangle, in the direction of the omo-hyoideus muscle, behind which it is also sometimes

directly situated; a circumstance important to recollect when we wish to tie this vessel. This operation might be performed without difficulty by following the method recommended for the carotid; only, instead of opening the sheath of the latter, we should push it outwards, whilst we detach inwards the thyroid gland and trachea, and draw the omo-hyoideus muscle upwards. The artery will always be found a few lines higher or lower in this space, quite near the fleshy bundle. In applying the ligature, we must exclude the two principal nerves which pass before and behind the vessel; consequently, we must vary the method according to the position of the parts; if the nervous trunks are very close to the trachea, the needle must be passed from below upwards and from within outwards; if these nerves are nearer the carotid, we should pass it in the opposite direction.

The ligature of the inferior and superior thyroid arteries is an operation which might be frequently performed, either on account of a wound of these vessels, or with the view of causing atrophy of the thyroid gland in bronchocele; or finally, for the purpose of enabling us to extirpate the thyroid body itself; which has already been done by several skilful surgeons, and especially by the celebrated Walther of Bonn. But it is necessary to recollect that a fifth thyroid artery sometimes exists in the direction of the median line.

We have occasionally met with this branch, which was first described by Neubauer in 1772, and since by almost all correct anatomists. It sometimes arises from the arteria innominata, but more frequently from the arch of the aorta; it then ascends in a more or less tortuous manner towards the inferior part of the thyroid gland, anterior to the trachea, covered by the thyroid veins, the aponeurosis and the skin. The existence of this artery would render *tracheotomy* very dangerous, and it would be difficult to apply a ligature around it on account of the very large veins which commonly run before it. It is also well to know that the thyroid arteries vary much in volume, position and even in number; and we should especially recollect that variety, described by F. Meckel, in which the thyroid of Neubauer originated from the brachio-cephalic trunk, and passed to the left lobe of the gland, crossing the anterior surface of the trachea; so that it would have been impossible to avoid wounding this vessel, if an

opening had been made into the air tube. According to M. Meckel, Burns has met with the same anomaly; but we have not been able to discover this fact in the work of the latter author.

The second or vertebral artery also originates from the subclavian: it is situated behind the internal jugular and carotid artery, and crosses them very obliquely from without inwards and from below upwards, in its course to the infra-hyoidean region; so that in some subjects it inclines a little within the common carotid. The great sympathetic and eighth pair cross it in the same direction, so that inferiorly these nerves are on the inner side, whilst superiorly they are on the outer side of the artery. On its inner side, it is in relation with the longus colli muscle, then with the inferior laryngeal nerve, the œsophagus and trachea; on its outer side, with the middle cervical ganglion and the filaments detached from it, with the phrenic nerve and scalenus anticus muscle; finally, it enters the canal in the transverse cervical processes, and passes on to the cranium.

VI. *The Veins.*

They are numerous and important in the infra-hyoidean region; the most conspicuous are,

(a) *The Internal Jugular.* This vein is situated on the outer side of the carotid artery, and accompanies it. They are both enveloped by a common fibro-cellular sheath, but have nevertheless each a distinct envelope. We distinguish the vein from the artery by the tenuity of its coats, which collapse, and are almost transparent; by its external position, and by the colour of its blood.

Upon the dead body, the internal jugular vein is generally flattened in such a manner as to form a semi-canal applied upon the external half of the carotid artery. Upon the living, its relative volume is much greater, so that it covers a considerable portion of the anterior surface of the artery, and its dimensions increase on expiration and diminish on inspiration. Hence it follows that the size of the internal jugular vein will be augmented, during the performance of certain operations, in proportion to the degree in which respiration is impeded: therefore at such times we should endeavour to calm the agitation of the patient, and induce him to make full inspirations. It is especially during the application

of the ligature of the carotid that this alternate dilatation and collapse greatly embarrass the operator. It is true that we might possibly prevent this, by compressing the vein above the place where we wish to lay bare the artery. The internal jugular vein is covered anteriorly by the parts which conceal the primitive carotid; only, as it is more external, the sterno-mastoid muscle covers it to a much greater extent; on the outer side of the vein are situated the phrenic nerve and the cervical plexus in general; internally, it touches the carotid artery, and is sometimes, as it were, even adherent to it; posteriorly, it crosses the inferior thyroid artery below, and the nervous filaments of the cervical plexus, which anastomose with the great sympathetic, above. In the latter direction it usually covers the ascending cervical artery, and rests upon the internal side of the scalenus anticus. It is between its internal posterior part and the carotid that the par vagum and great sympathetic are situated; so that in order to avoid wounding these nerves when we are trying to isolate the vein, the needle should be introduced on the outer side of the artery. Where the jugular empties into the subclavian vein, it generally conceals the vertebral artery. Its anterior part receives a great number of veins, which cross the common carotid, and may thereby cause considerable perplexity when we attempt to apply a ligature around this artery; and these veins are the more annoying on account of their irregularity, in relation to number, magnitude and position. Be this as it may, all these venous branches appertain to the organs which constitute the supra and sub-hyoidean regions, and are particularly congregated below the cornu of the os hyoides, on the one part, and at the inferior part of the region, above the sterno-clavicular articulation, on the other. We may also state that some venous ramusculi, of a certain calibre, from the supra-cavicular region and anterior part of the chest, often pass through the latter point, especially on the left side, in their course to the subclavian or internal jugular.

When this disposition exists, a more or less complicated plexus is the result, which might increase the difficulties of tying the subclavian artery within the sterno-mastoid muscle.* It also follows from this arrangement that, in order to avoid these veins,

* Langenbeck, loco citat.

when we seek for the carotid, it is much better to lay it bare either immediately above or below the omo-hyoideus muscle.

(*b*) The *external Jugular Vein* usually appertains to the supra-clavicular region, where we will examine it; sometimes, however, we find it in the sub-hyoidean region, or it may exist there at the same time that another is situated in the usual position. In this case, it is generally smaller, and the other bears the name of anterior jugular. We have sometimes found the anterior jugular with the external, and we have met with it single, upon the dead body, three different times. The anterior jugular vein sometimes receives the greater portion of the branches of the face and sub-maxillary region; at other times it appears to be formed solely of some thyroid branches which have deviated from their natural direction. Its trunk sometimes opens near the larynx, in the internal jugular; more frequently it descends singly to the inferior part of the neck, and then empties into the same vessel; and again it proceeds directly to the subclavian, especially on the left side. In some subjects this vein is very large, and might be opened with equal facility and in the same manner as the external, if thought necessary.

In general, when it supplies the place of the external jugular, it lies superficially upon the aponeurosis; at other times, it runs between the muscles and the fascia cervicalis which it traverses, especially when it comes from the thyroid gland. It is on this account, that, when we operate upon the deep-seated organs, we should divide the tissues cautiously, in order that we may tie or push it aside, if we are unwilling to divide it.

(*c*) The *Thyroid Veins*. They are proportionately larger in children than adults, in the female than the male; and their volume is generally in a direct ratio to that of the gland. They may be arranged under two orders: those which follow the direction of their collateral arteries, are a little more superficial, and cross the carotids anteriorly, in order to terminate in the internal jugular vein: the others collect below the gland, forming three, four, or five principal branches, which descend before the trachea, where they constitute a species of plexus between the sterno-thyroid and sterno-hyoid muscles. It is this sub-thyroidean plexus which renders tracheotomy dangerous, because it is difficult to avoid all these veins, and consequently hæmorrhage. It is

enveloped in a lamellated cellular tissue, and its branches empty into the subclavians as they approximate the trachea. It is proper to observe that it would be more easy to reach the trachea, without wounding these veins, in the vicinity of the sternum, than immediately below the thyroid gland, because in the former situation these vessels run in a parallel direction, whilst, in the latter, they intersect one another in divers manners. Furthermore, they lie beneath the aponeurosis; so that they cannot be distinguished through the skin, even when they are in a varicose state.

(*d*) *The other veins* of the infra-hyoidean region empty into one of the preceding branches, and do not require further consideration. The facial and lingual veins also descend into this region, and are found below the great cornu of the os hyoides; but they form a part of those which cross the carotid artery superiorly, and which were pointed out in the commencement of this paragraph.

VII. *The Lymphatics.*

These vessels are numerous and pretty well understood; some of them descend into the glands of the mediastinum; others into those of the axilla; but the greater number terminate under the sterno-mastoid muscle.

It is very necessary to have a correct knowledge of the glands of this region, on account of the variety of diseases to which they are subject. In the first place, they form a very remarkable chain around the internal carotid and internal jugular; there are also some others of smaller size behind the sub-thyroidean plexus, upon the anterior part of the trachea, and lastly we sometimes find one of them upon the fore part of the larynx.*

When these glands become tumefied, they may be mistaken for other affections. Thus, the slow and gradual developement of one of those in the carotideal groove, may lead to the supposition that an aneurism of the carotid, of one of its branches, or of the inferior thyroid exists. This mistake may easily be made in consequence of the enlarged gland being firmly compressed, by the laminae of the cervical aponeurosis and the sterno-mastoideus muscle, against the artery situated behind it, whereby a pulsatory motion is transmitted to the tumour.

*Burns.

Those situated before the trachea may be mistaken for an enlargement of the thyroid gland, and we are of opinion that this organ is said to have been removed more than once, when one of the surrounding lymphatic glands merely was extirpated. Be this as it may, as they correspond to the aponeurosis in those places where it is thickest, they will, as they enlarge, compress the trachea and œsophagus, and by suspending respiration and deglutition produce alarming consequences.

The gland described by Burns may also become greatly enlarged; as has occurred to this author's notice; and may thereby lead to numerous errors, and occasion unpleasant results.

Lastly, we find some very small absorbent glands, between the œsophagus and trachea, around the recurrent nerves. Should these become diseased, it would be much more difficult, on account of their depth, to form our diagnosis, than in the preceding cases.

VIII. *The Nerves.*

The nerves of this region are very numerous, and merit much attention.

(*a*) From the cervical plexus, it derives both superficial and deep-seated nerves.

The former appertain to the filaments which ascend before the larynx and under the chin, between the aponeurosis and the platysma. They are flattened, hard, and appear to preside over sensation. These branches would necessarily be divided when a ligature is applied around the carotid in the *omo-hyoidean* triangle. Their inosculation with the facial account for the pain, sometimes very acute, which subcutaneous tumours of the neck give rise to in the face.

The latter are filaments of communication with the great sympathetic, etc., and especially the branch which anastomoses in the form of a loop with the *descendens noni*. As this branch comes out from beneath the sterno-mastoid, it crosses the anterior part of the jugular vein very obliquely, before it unites with the filament of the ninth pair. The other branches of the cervical plexus pass behind the deep vessels of the neck.

(*b*) We next find the *ramus descendens noni*. It separates from the trunk or hypo-glossal nerve as high up as the os hyoides, and runs first on the outer side of the internal carotid, afterwards

upon the anterior part of the common carotid. Sometimes it abandons this vessel, approximating nearer the larynx or trachea, but more frequently passes outwards upon the jugular vein. In either case we should bear it well in mind when we wish to tie the common carotid; for it is much better to make a complete section of this nerve than to comprise it in the ligature. It is in the vicinity of the omo-hyoideus muscle that it unites with the internal descending branch of the cervical plexus. The filaments originating from this union form, in certain subjects, behind or beneath this muscle, a sort of plexus, called by some the *superficial cervical plexus*.

Previous to these filaments being distributed to the muscles, they cover the primitive carotid artery, and cause more or less perplexity when we apply a ligature around this vessel in the *omo-tracheal* triangle.

(c) In the third place we find the par vagum (*pneumo-gastrique*), the largest and most remarkable of all the nerves of the neck. This nerve is situated before the base of the cervical transverse processes and the soft parts which immediately cover them, and is itself covered by the carotid and the internal jugular vein: it is then between and behind these two vessels that we constantly find the par vagum; before, on the outer, and sometimes on the inner side of the great sympathetic nerve, to which it is always closely approximated. In this place, the pneumo-gastric nerve cannot be confounded with any other organ. The lamellated cellular tissue which envelopes it is very dense and very compact; and as it is this same cellular tissue which forms a sheath for the artery, it follows that we should be particular, when tying the latter, to exclude the nerve from the ligature. In order that we may accomplish this end more surely, and at the same time disturb the parts as little as possible, we should introduce the needle close along the outer side of the artery, leaving the par vagum external to it.

This step is also rendered much more easy by making a cautious incision through the arterial sheath, previously pinching up this sheath, and making a small horizontal cut, sufficiently large to admit the introduction of a director, upon which the opening may be dilated. In this manner the artery is completely isolated, all the nerves remain untouched; no tissue is lacerated, in short all

the parts are left in the state best adapted for their prompt reunion.

The par vagum gives off two principal branches in the sub-lyoidean region, which are the two laryngeal nerves.

(*d*) The superior laryngeal nerve separates from the trunk opposite the os hyoides, and is at first situated behind the carotid, near its bifurcation; it then glides along its inner side, in order to arrive, on the one hand, at the posterior part of the thyroid gland, and on the other, upon the thyro-hyoid membrane; sometimes it is situated higher up than the superior thyroid artery, at others, lower down, but always deeper. Nevertheless, it follows nearly the same direction as this artery; a circumstance which must be recollected when we wish to tie this vessel; for the section of this nerve would almost certainly be attended with dumbness.

(*e*) The inferior branch, or recurrent nerve, is longer on the left side than on the right, because, in the first direction, it passes under the arch of the aorta, whilst, in the second, it turns round the subclavian and ascends to the larynx along the *œsophago-tracheal* gutter, or, in other words, between the carotid artery which is external, the *œsophagus* and trachea, which are internal. This nerve is at first nearest the artery, but afterwards approximates the respiratory and alimentary tubes, to which it distributes a great number of filaments. Hence it follows that the inferior laryngeal nerve may be wounded in *œsophagotomy*; in extirpating the thyroid gland; in tying the inferior thyroid arteries, or the common carotid when performed in the *omo-tracheal* triangle, or the subclavian on the inner side of the sterno-mastoideus muscle.

(*f*) We must also notice the cardiac filaments given off by the eighth pair. They are more numerous on the left side than on the right, and remain a long time behind the trunk of the carotid. Of themselves they possess but little consistency, but their tenacity is very much augmented by the cellular tissue which envelopes them. They are particularly adherent to the arterial sheath, especially in the upper half of the region, which affords an additional motive for opening this sheath when we wish to tie the carotid: indeed, without this precaution, it might frequently happen that one of the cardiac nerves of the par-vagum would be included in the ligature, which would not fail to occasion more or less disturbance in the action of the heart.

(g.) The great sympathetic nerve (*le nerf de la vie intérieure*) is also concealed by the carotid, lying deeper than, and on the inner side of, the par-vagus. A part of its superior ganglion, the whole of its middle ganglion, when it exists, the two cardiac nerves, and numerous accessory filaments are found in this region. Enveloped in the lamellated tissue of the deep parts of the neck, having nearly the same relations with the important vessels of this part, the great sympathetic nerve is susceptible of the same surgical applications as the *nervus vagus*, when we perform operations upon this region.

ix. *The Larynx and Trachea-Arteria.*

Situated upon the median line, the laryngo-tracheal canal presents relations which are common to all the parts entering into its composition, and others which are peculiar to each of these parts. It is covered throughout its whole extent; anteriorly, by the double sheet of the cervical aponeurosis, the subcutaneous layer and skin; more externally, by the sterno-hyoidei muscles, the aponeurosis, the platysma and the two laminæ which envelope it, lastly by the skin. The carotid arteries, pneumo-gastric nerves, great sympathetic, and the jugular vein, run deep along its sides throughout its whole extent.

The different portions of this canal also have special relations, which must be examined separately.

(a) In the first place we find the *thyro-hyoid membrane*, of the nature of the ligamenta flava (*ligamens jaunes*), the posterior surface of which, separated from the epiglottis by a triangular space which is filled with adipose cells and which lodges the epiglottic gland (*periglottis*), is only removed from the pharynx by the mucous membrane.

Anteriorly, this membrane is covered by an arterial branch and some small twigs of the superior thyroid; by the superior laryngeal nerve, which penetrates through it into the larynx, into which some filaments from the ninth pair also pass; by a cellular layer in which the vessels and nerves just mentioned are imbedded; by the omo-hyoideus, sterno-hyoideus, and thyro-hyoideus muscles; finally by the aponeurosis, platysma and the skin.

The length of the thyro-hyoid membrane is about sixteen lines,

and it is thicker in the middle than upon the sides. From its disposition, instruments or weapons which divide it transversely, or in any other direction, naturally tend to pass into the pharynx, and, consequently, may not strike the glottis: for which reason these wounds do not ordinarily produce mutismus, since the voice is incontestibly formed in the larynx. Nevertheless, these wounds may occasion unpleasant consequences, from their frequently dividing the laryngeal nerve and the thyro-hyoid artery. As this membrane is more depressed than the os hyoides and thyroid cartilage, there is consequently a species of groove formed between these two organs, and it is in this groove that instruments are most commonly placed in attempts at suicide; and it is for this reason that individuals desirous of committing this act, do not always succeed in accomplishing it. It is likewise in this place that the knot of the hangman's cord generally stops.

(b) The *Larynx*, properly so called, presents for our consideration, in the first place, the thyroid cartilage; next the cricoid, and lastly the crico-thyroid membrane.

The first is harder and more disposed to ossify than the second: its superior margin is notched out and forms a very considerable prominence, especially in man; indeed the difference in the degree of this prominence is so great in the two sexes, that it would merely be necessary to feel this part in the adult in order to distinguish them. This cartilage is about an inch in length; its external surface forms two planes which are inclined backwards, upon which the thyro-hyoid and sterno-thyroid muscles rest; its internal surface presents two other planes which include the essential parts of the larynx, that is to say, the parts which constitute the glottis; and it is in the retiring angle formed by their junction, two lines below the superior median notch, that we find the anterior extremity of the *cordæ vocales*, then a little lower, the thyro-arytenoidei muscles; so that in performing *laryngotomy*, according to Desault's method, the cartilage should be divided exactly upon the median line, otherwise we will be liable to wound the ligaments of the glottis.

The second, or cricoid cartilage, increases in width as it proceeds backwards, and is surmounted posteriorly by the arytenoid cartilages, which are articulated with it in such a manner that they may be flexed anteriorly and laterally, according to our opinion

and that of most physiologists ; or laterally only, as M. Magendie supposes. Posteriorly, this cartilage is covered by the crico-arytenoidei postici and laterales muscles ; afterwards it corresponds to the origin of the œsophagus, or to the termination of the pharynx ; laterally, we find the crico-thyroidei muscles ; anteriorly, there are no particular organs, excepting occasionally some vascular ramusculi ; it is seldom that the thyroid gland reaches so high up. It is on a level with it that the trunk of the recurrent nerve is lost among the tissues, after the same manner that the superior laryngeal nerve is expanded above the thyroid cartilage ; and the last twigs of these nerves are distributed to the proper muscles of the larynx. But authors are not agreed respecting the precise spot where they terminate. M. Magendie thinks that the superior laryngeal is distributed merely to the arytenoid and crico-thyroid muscles, whilst the inferior distributes its filaments to the crico-arythenoid and thyro-arytenoid muscles ; so that there would be a distinct nerve for the dilator muscles, and another for the constrictor muscles of the glottis ; but notwithstanding the authority of this *savant*, we cannot subscribe to his opinion, because we have frequently traced a filament of the recurrent nerve even into the arythenoid muscle, etc.

The transverse diameter of the *membrana crico-thyroidea* is four or five lines, its perpendicular height from three to four ; it is of the same nature as, but much stronger than the thyro-hyoid membrane. Its use appears to be merely to fill up the space which separates the cricoid and thyroid cartilages : it becomes folded when these cartilages approximate or overlap each other, and for this reason the chin should be elevated when we puncture this membrane. No organ of importance covers it anteriorly, excepting the crico-thyroid artery ; and in order to lay bare this membrane, we will have to divide the skin, fascia superficialis, platysma and the layer which supports it, the aponeurosis and the several cellular sheets which are collected upon the median line after having enveloped the muscles, which are also easily separated. The artery, however, deserves the greatest attention, as it almost always forms a complete loop which crosses this membrane transversely. If this loop was of considerable volume, which is frequently the case, its division might occasion a troublesome hæmorrhage : on the one hand, because it would be difficult to stop

the blood by compression; and on the other, because this fluid might make its way into the larynx, through the opening which has been made, and produce suffocation: therefore the two extremities of the arterial arch should be tied as soon as divided. In order, however, that we may avoid a similar accident, in performing the operation recommended by Vicq. d'Azyr, we may proceed in different ways. For example, do we wish to open the crico-thyroid membrane simply for the purpose of giving admission to air, we should incise the tissues parallel to the direction of the artery, which we push up or draw down with the nail; do we, on the contrary, operate in order to extract a foreign body, one of two cases will be present; either this body will be above the cricoid cartilage, or it will be below it. In the first case we would be obliged to follow the advice of Desault, which is to divide the thyroid cartilage from below upwards; then before we perforate the membrane, we should ascertain the size and exact situation of the artery. If the finger does not discover it, or its pulsations are not felt, it is certain that this vessel is small, and that its section will not be attended with danger. If, on the other hand, its pulsations are very perceptible, we may be sure that its volume is considerable, and we should then draw it down as much as possible, in order to commence the incision above it, or if we cannot dispense with cutting it, it would be better to tie it beforehand.

In the second case, it will be necessary to divide the cricoid cartilage from above downwards, as recommended by Boyer, and then the artery will require the same precautions as in the preceding, except, however, that it should be drawn upwards. We must also recollect that the air-tube is only seven or eight lines in diameter opposite to the part under consideration, so that we should hold the bistoury in such a manner that it will not penetrate its posterior wall. For the same reason also we should, when we divide either of the cartilages, use a probe-pointed bistoury, and the canula which we introduce should be so short that its extremity will remain free in the laryngo-tracheal canal.

(c) The *Trachea*. Its two superior third portions exist in the sub-hyoidean region; its membranous, or posterior fourth portion, lies upon the œsophagus, to which it is united by means of a lax cellular tissue, and from this disposition we may account for

the passage of foreign bodies, which have lodged in the œsophagus, into the trachea, and *vice versa*; anteriorly and laterally it is immediately enveloped by the thyroid gland.

Although the functions of the thyroid gland have not been correctly ascertained by physiologists, it nevertheless performs an important part in surgery; either on account of the diseases to which it is exposed, or its complicated relations.

This gland is enveloped in a species of fibro-cellular sac, which is sometimes so dense that it is very difficult to distinguish the fluctuation of pus or any other fluids which may be collected within it, and it is this envelope also which permits the thyroid to become considerably enlarged without contracting intimate adhesions with the surrounding organs.

The two lobes which constitute it are sometimes almost completely separated, or at least united by a single band, which is sometimes placed at its inferior part, leaving the larynx and three or four rings of the trachea completely free in the sinus which results from it; a disposition which admits of the performance of laryngo-tracheotomy without danger; at other times, on the contrary, the vinculum is much higher up, sometimes even on a level with the cricoid cartilage, when the preceding operation will be attended with some hazard. There are also other cases in which these two lobes are blended together along almost the whole of their internal border; whereby the air-tube is entirely concealed by the gland, from the larynx to the fifth, sixth, and sometimes even the seventh cartilaginous ring.

Anteriorly, this gland is convex and covered by the anterior sheet of its capsule, by the sterno-thyroid and sterno-hyoid muscles and the common integuments; the omo-hyoideus passes more externally and superiorly. Posteriorly it is excavated in the form of a gutter, in order to receive the commencement of the trachea, from which it is separated only by a dense cellular layer and its tunica propria. Laterally it rests upon the inferior laryngeal nerves, slightly upon the œsophagus on the left, upon the primitive carotid artery and upon the origin of the principal divisions of the arteries which bear its name.

From these relations it follows that tumours of the thyroid gland, bound down by the cervical aponeurosis and the muscles, may enlarge most posteriorly, and by compressing the trachea

and other organs lying in this direction, give rise to serious consequences. It is with the view of preventing these consequences as well as removing a disease in itself fatal, that surgeons have so frequently manifested a desire to extirpate the thyroid body. We may now readily appreciate the difficulties of such an operation; in fact the division of the muscles, almost always indispensable, must, even admitting its complete success, in a great measure prevent the depression of the os hyoides, after the cure. The inevitable division of four or five thyroid arteries demands a multiplicity of ligatures, and may give rise to an exhausting hæmorrhage. The innumerable veins which are contained in this organ, must likewise pour fourth an abundance of blood, because, in these agonizing moments, inspiration is but indifferently performed. We have also to apprehend the admission of air into the open mouths of these veins, which, in the opinion of M. Larrey, from Magendie's experiments, and some cases derived from man, among others those which have come under the observation of Dupuytren, etc., may cause the instantaneous death of the patient. Neither must we forget that, in the pathological state of the thyroid requiring its extirpation, all these vessels have undergone considerable dilatation. Finally, the thyroid gland is sometimes so greatly enlarged externally, and so intimately united to the parts situated behind it, that it is sometimes difficult to avoid the trachea, the carotid and even the internal jugular vein.

Notwithstanding all these unfavourable circumstances, the operation under consideration has already been performed a great number of times, and M. Hedenus relates six cases of goître in which it has been attended with complete success.*

The means by which most of these dangers and difficulties may be avoided is by previously tying the four thyroid arteries. This preliminary step of the operation is generally of easy performance upon the dead subject. Waltier de Bonn has successfully performed it upon the living for an aneurismatic goître. Perhaps it would be well also to tie the large sub-thyroid venous trunks, in order to prevent the admission of air into them: and, finally, we might preserve in part the action of the muscles upon the

* *Commentarius de glandule thyroideæ extirpatione.* Hedenus filius. Leipsick, 1322, 4to.

larynx, by previously cutting them across, and reflecting them towards their points of attachment, in order that their extremities may be approximated after the operation.

Below the thyroid gland, the trachea-arteria corresponds to the supra-sternal *fossette* of the sub-hyoidean region. Its immediate covering is a lamellated and filamentous cellular tissue, in which there are a great quantity of adipose vesicles, and sometimes one or more lymphatic glands, the tumefaction of which might occasion great disturbance in the exercise of the respiratory and digestive functions. These diseased glands may be mistaken for aneurism of the commencement of the carotids or subclavians, or for a pathological development of the thymus, which, in children, naturally ascends a little into the supra-sternal space.* On the other hand, this cellular tissue is sometimes the seat of acute or chronic inflammations which terminate by suppuration, the abscesses resulting from which are generally detected with difficulty, on account of the aponeurosis behind which they are situated. It is very essential, however, to open them early; for the fluid will penetrate into the chest with the greatest facility.

In the next place we find, in proceeding from the deep-seated parts towards the skin, the inferior thyroid veins; the artery of the same name, when it exists; the aponeurosis, which is here very thick, and lastly the subcutaneous cellulo-adipose layer. The latter lamina is usually very thin, and the purulent, or other fluids, which collect in it, soon render the skin prominent. The aponeurosis here consists of two very distinct sheets, one of which is fixed to the anterior, the other to the posterior part of the sternum; so that abscesses or tumours which are developed between them, do not communicate so directly with the cavity of the thorax as they do when they form in the cellular tissue which immediately covers the trachea. The veins are naturally very large; but they are considerably larger in goitre and other affections of the thyroid gland: these are the veins which render *bronchotomy*, or rather *tracheotomy* so dangerous that several intelligent persons have thought proper to proscribe this operation. The principal cause of apprehension is that the blood, which obscures the view of the operator, will make its way into the air

* Burrs.

tube and produce suffocation. A case related by Virgili strengthens this opinion. Besides, we find it more convenient and less dangerous to divide the crico-thyroid membrane only, when our object is to re-establish respiration, and at the same time to divide one or the other of the cartilages when it is required to extract a foreign body; nevertheless the trachea has been opened a great number of times between the thyroid gland and sternum, in the last stage of croup, without any serious consequences apparently resulting from it. The greater part of the subjects died, it is true; but it is too evident that the fatal termination was to be attributed to the disease, not to the operation. Indeed, it would seem that this therapeutic resource has been too frequently rejected in this dreadful angina. It is at least a fact that, by this means, M. Bretonneau succeeded in saving the life of the daughter of Count Puysegur. Three of the children of this learned philanthropist had been cut off by croup; the fourth appeared without resource, and upon the point of undergoing the fate of her brothers. M. Bretonneau, encouraged by the unhappy father of the little patient, decided upon dividing the trachea; portions of the accidental membrane in the form of shreds, and sometimes resembling cylinders moulded upon the bronchi, were expelled or extracted during several days, and on the fifteenth day after the operation the patient was completely cured.

In order to avoid the accident which caused the death of Virgili's patient, we should cut three rings of the trachea at least; by this means the blood which flows into the trachea during inspiration is expelled by expiration; and there is no danger from a large opening made into this canal.

When the thyroid artery of *Neubauer* exists, it is situated behind the veins, and usually a little to the right. It may likewise be distinguished by its pulsations, the thickness of its coats and the distribution of its branches.

More externally, the relations of the trachea are not exactly the same on the left side as on the right; that is to say, the aponeurotic sheets and sterno-hyoid and sterno-thyroid muscles, etc., cover it equally on both sides; but the primitive carotid is closer to it, more anterior and more superficial on the right than on the left; a disposition which it is important to note, especially on account of the mobility of the air-tube; for if the latter should glide

only a few lines to the right, when we are performing *tracheotomy* in the inferior part of the neck, the instrument is in danger of falling upon the carotid artery; a circumstance which actually happened to a student of medicine, who was desirous of resuscitating one of his friends, whilst in a state of asphyxia.

The great mobility of the laryngo-tracheal canal is a circumstance against which we cannot be too much upon our guard, and it is for the purpose of restraining this that the instrument of Bauchot was invented. It is this mobility which principally prevents our penetrating this tube by a simple puncture, whether we make use of the *trois-quarts* recommended by Junkers, Deckers, etc., or the sharp-pointed bistoury as advised by Dionis. The trachea will always tend to slide under these instruments; and, on the other hand, if their point should succeed in perforating it, the force made use of to overcome the resistance which its elasticity occasions, will frequently carry the instrument so far as to wound other organs.

In addition to the mobility and elasticity of this canal, there is still another reason why we should not employ puncturing instruments in tracheotomy. In fact, a single puncture being only serviceable in admitting air into the lungs, it will always be more easy and safe to make an opening between the two cartilages of the larynx than through the trachea. But in croup, as well as for the extraction of foreign bodies, it is necessary to incise several fibro-cartilaginous rings vertically; for punctures, in such cases, would always be insufficient; and we may remark finally, that by dividing the tissues parallel to the trachea, it is much more easy to separate the vessels which cover it.

It remains for us to mention, before concluding our observations on this important canal, that the escape of the air through an aperture below the thyroid cartilage invariably destroys the voice; therefore surgeons should always make it a rule to bring the divided edges of the wounds of these parts in as exact coaptation as possible. Sounds being formed in the glottis, it is evident that, if the air, which is the sonorous body, escapes below it, the voice will not be formed. Numerous experiments made upon dogs by Bichat, and others, as well as observations derived from man by MM. J. Cloquet and Magendie, have demonstrated this point of physiology to a mathematical certainty.

x. *The Œsophagus*

The œsophagus commences opposite to the fourth cervical vertebra, and appears to be only the continuation of the pharynx; the inferior part, is consequently, comprised in the sub-hyoidean region.

The œsophagus is at first situated upon the median line behind the cricoid cartilage, and afterwards inclines slightly to the left, so as to pass a few lines beyond the trachea in this direction. It rests upon the bodies of the vertebræ, and is connected to the fibrous tissues which unites these bones only by very extensible cellular laminæ. We have already stated that its anterior portion was pretty intimately attached to the posterior gutter of the trachea. On the right, it is in part concealed by the latter organ, and close along this side runs the recurrent nerve, then the carotid artery, etc. On the left, it is more immediately covered by the thyroid gland; it is crossed by the inferior thyroid artery, and the recurrent nerve is more upon its anterior part than on the right side; which renders the section of this cord more easy: finally, the carotid is a little nearer to it, because on the right the œsophagus is entirely covered by the trachea.

It is owing to these anatomical relations that it is laid down as a rule always to perform *œsophagotomy* on the left side, and as much as possible between the thyroid gland and sternum. In order to reach the œsophagus at this point, we cut down as if we were about to tie the carotid; we then push this artery outwards, the sterno-thyroideus muscle forwards and towards the median line; a thick fibro-cellular lamina presents itself, which is next to be divided, when the canal of deglutition is exposed to view. All that is then necessary to avoid is the recurrent nerve and trachea.

However, notwithstanding surgeons have kept silence in this respect, foreign bodies can seldom descend so low and then stop, if it is their magnitude alone which opposes their passage to the stomach. In fact, when they have succeeded in passing the origin of the œsophagus, and have got beyond the cricoid cartilage we do not see what can impede their further progress. Therefore, it is on a level with the inferior part of the larynx that we

will be most frequently obliged to perform *œsophagotomy*. The operation will then be much more difficult and dangerous, since we will have to avoid the thyroid gland and its arteries, and will also have to cut deeper for the organ, which has not as yet deviated to one side or the other. In all these cases the instrument of M. Vacca Berlinghieri, or that of Prof. Dupuytren will overcome many difficulties.

XI. *The Skeleton.*

There is no skeleton properly appertaining to the sub-hyoidean region: it rests upon the bodies of the last four cervical vertebræ. These bones form a convexity at this part, which seems to serve as a point of support to certain very heavy metallic rods, introduced by jugglers into the œsophagus and balanced in the air. We will have occasion, however, to speak of the spinal column in another place.

Sect. 3. The Supra-Clavicular Region. (See plate 4.)

The supra-clavicular region is bounded, anteriorly, by the sub-hyoidean, submaxillary, and parotideal regions; that is to say, by a line drawn from the sterno-clavicular articulation, along the anterior margin of the sterno-mastoid muscle to the anterior part of the mastoid process; posteriorly, by another line extended from the acromio-clavicular articulation, along the anterior border of the trapezius, to the posterior part of the mastoid process; and inferiorly, by the clavicle and first rib. Consequently, it forms a regular triangle with its base below.

Upon its anterior limit we observe an elongated eminence, which is very evident when the head is inclined towards the shoulder, and the face to one side, and which is formed by the sterno-mastoid muscle. The trapezius forms another relief posteriorly, which is blended at the summit with the preceding eminence. In the interval of these two species of columns there is an excavation, which is deeper in the adult than the child, in man than in woman, in thin than in fat subjects, and which is increased or diminished according to the elevation or depression of the shoulder. This is the supra-clavicular excavation, and is the most

important part of the region, whether we consider it in relation to the numerous organs it includes, the diseases which are developed in it, or the operations which may be performed upon it.

CONSTITUENT PARTS.

I. *The Skin.*

This membrane is very strong, very thick, and but slightly extensible superiorly, where it is firmly adherent to the subjacent tissues; but as it descends it gradually becomes thinner and more moveable upon the muscles; so that in the supra-clavicular *fossette*, it assumes all the characters which distinguish the skin of the sub-hyoidean region. In some persons it is dark coloured and covered with hairs, in the superior fourth part of the region; throughout the rest of its extent it is smooth, and contains a few small sebaceous follicles.

II. *The Subcutaneous Layer.*

This layer, like that of the preceding region, is composed of a cellulo-adipose lamina, immediately attached to the skin; of the platysma, which does not extend quite to the margin of the trapezius, and of another supra-aponeurotic cellular lamina, which resembles the fascia superficialis.

These two sheets are blended together wherever the platysma does not extend, and form a dense and very strong layer in the superior half of the external surface of the sterno-mastoideus. There they are very closely united to the aponeurosis on the one hand, and to the skin on the other; which explains the slight extensibility of the latter. Adipose vesicles are seldom developed in it, and when abscesses or tumours form in it, although their nature may be acute, they are generally slow in manifesting themselves externally; a circumstance which is explained by the tenacity of the tissues. Inferiorly, these two laminæ are transformed into a simple lamellated and filamentous cellular tissue, in which nervous filaments ramify and adipose vesicles are sometimes abundantly deposited. It is in the lamellæ of the sheet under the platysma, that the external jugular vein and several

branches of the cervical plexus are situated. It is necessary to observe that the fibres of the platysma itself are more scattered and paler in its inferior portion ; so that in a great many subjects they are scarcely distinct behind the clavicle. The direction of the fibres of this muscle is upwards and inwards, crossing the external surface of the sterno-mastoideus very obliquely. This last peculiarity relates especially to the jugular vein, as we shall see directly.

III. *The Aponeurosis.*

The *fascia cervicalis* is much more irregular here than in the sub-hyoidean region. Nevertheless, in emaciated subjects and those advanced in life, it is generally very distinct and sometimes even very strong ; it is composed of several sheets, which it is possible to separate in some places. Thus, two fibrous laminæ, which constitute the aponeurosis, properly so called, envelope the sterno-mastoideus muscle ; at its posterior border they reunite, and again separate when they arrive at the margin of the trapezius. Those laminæ which have formed sheaths for the deep-seated parts of the sub-hyoidean region, for the omo-hyoideus muscle, the nerves of the brachial and cervical plexus, and which have covered the scaleni muscles, etc., afterwards become blended with the internal surface of the deep sheet of this aponeurosis. All these lamellæ are very dense and difficult to lacerate, and oppose the easy insulation of the vessels and nerves, which they seem destined to protect. In the inferior part of the supra-clavicular fossa, there is a considerable quantity of filamentous cellular tissue and adipose vesicles intermingled with these lamellæ. As this species of cellular filter is continuous with similar structures in the hollow of the axilla, it naturally follows that pus, etc., accumulated beneath the aponeurosis, will readily infiltrate into the latter region, by following the sheaths of the nerves and vessels, or the interstices which separate them. The abundance of this cellular tissue and its diffusion with the aponeurosis between the principal muscles, explains the tendency which superficial tumours and abscesses have to become deep-seated ; and in consequence of this arrangement, we should always give an early exit to purulent collections which may be developed beneath the skin of this region.

IV. *The Muscles.*

This region contains a considerable number of important muscles.

(a) The *Sterno-Cleido-Mastoideus* is enveloped in a fibrous sheath, and the superior part of its posterior margin is blended with the splenius capitis; inferiorly, it is attached to the sternum, and its internal tendon sometimes gives considerable strength to the sterno-clavicular articulation, to the anterior part of which it is applied. The external surface of this muscle is covered by the external jugular vein, the mastoidean, auricular, and submaxillary branches of the cervical plexus, and the layers which we have just passed in review; and it is frequently crossed near its origin by the acromio-clavicular vein. Its deep surface rests, from above downwards, upon the trachelo-mastoideus (*petit complexus*) and the digastricus, upon the occipital artery and cervical plexus, upon the omo-hyoideus and scaleni muscles, upon the carotid artery and internal jugular vein, which last is seen a little external to its posterior border, and finally upon the subclavian vein. We have already mentioned that the anterior margin of this muscle serves as a guide to the carotid artery. It is traversed in its superior third by the spinal accessory nerve.

(b) The *Trapezius*. The clavicular portion only of this muscle is situated in this region; its fibres ascend obliquely upwards and backwards. Included between the two laminæ of the aponeurosis, it is separated from the skin merely by the cellular layer; but its anterior surface is separated from the omo-hyoideus and scalenus posticus muscles, from the nerves and vessels, by an excavation of considerable depth, which is filled by a simple cellular or adipose tissue, in which several nervous and arterial branches ramify. Its anterior margin is curved, its concavity looking forwards; inferiorly, it serves to limit the incisions which are made for the purpose of discovering the subclavian artery.

(c) The *Levator Anguli Scapulae*. It follows the posterior line of the region, and lies exposed between the two preceding muscles, where it is about to attach itself to the transverse processes of the vertebræ. An adipose and cellular layer, of great

er or less thickness, separates it from the trapezius. Its anterior surface is removed from the superior part of the chest and the splenii by some very lax and very extensible cellular tissue, which establishes a communication between the supra-clavicular region and the space comprised between the serratus magnus, the intercostales and rhomboideus muscles; a communication which enables pus, or other fluids, to penetrate from one of these regions to the other.

(d) The *Omo-hyoideus*. This muscle frequently possesses a middle tendon, where it passes under the sterno-mastoid muscle. It crosses the subclavian vein and artery, the three or four last nerves which go to form the brachial plexus, the two scaleni muscles, the phrenic nerve and ascending cervical artery, obliquely from below upwards. Sometimes, but not most frequently, as Langenbeck asserts,* it is united to the posterior convexity of the clavicle. In this case, a fibrous process is usually detached from it, which fills the sinus resulting from the union of the clavicle, acromion and coracoid process; which sinus, or space, is transformed into a triangle by the muscle in question.

The omo-hyoideus, in ascending before the scaleni, circumscribes another very important triangle, which might be called the *omo-clavicular* space: this space is divided into two by the scalenus anticus.

In the internal portion, we meet with the termination of the two jugular veins, and the subclavian into which they discharge their blood; the vertebral and inferior thyroid vessels; the acromial vein, and phrenic nerve; the supra-scapular, posterior and ascending cervical, internal mammary and subclavian arteries, and the origin of the last cervical nerves.

In the external, we also find the subclavian vessels, the supra-scapular and transverse cervical veins, the posterior scapular artery, the last three cervical and first dorsal nerves, finally a part of the scalenus posticus muscle and of the first rib.

With the trapezius and sterno-mastoideus, the muscle under consideration limits a third triangle, which might be denominated *omo-trapezian*. In this space we find the cervical plexus and the origin of the branches given off by it; the fourth and fifth pairs which go to the brachial plexus; divers branches of the

* *Bibliothèque, etc.*, vol. iii. Cahier 2, 1821.

transverse cervical vessels, and, from above downwards, the terminating extremity of the splenius capitis and splenius colli, the angularis scapulæ and scalenus posticus muscles; lastly, but deeper-seated, the trachelo-mastoideus, and one of the arches of the vertebral artery.

(e) The *Scaleni*. Inferiorly, they sometimes form three or four distinct bundles, but generally there are only two, which are so arranged that the posterior* passes outwards and backwards, in order to attach itself to the first rib, being also prolonged upon the second: the anterior is shorter and more rounded, and descends more internally and anteriorly, in order to become inserted into the tubercle of the same rib by a species of tendon. The former is related in a remote manner to the levator scapulæ and trapezius, and is covered anteriorly by the five nervous branches which run to form the brachial plexus; by the trunk of the subclavian artery and the first twigs which depart from it, in order to pass externally. The latter is separated from the scalenus posticus by a triangle the base of which is upon the first rib, and in which we find, at its most inferior part and a little anteriorly, the subclavian artery; more superiorly and posteriorly, the first intercostal nerve united to the last cervical, then the sixth cervical: still higher, a fleshy fasciculus which sometimes descends from the posterior surface of the scalenus anticus upon the costal extremity of the posticus; finally, above this fasciculus, in the apex of the triangle, the first two branches of the nerves which go to the brachial plexus. Anteriorly, the scalenus anticus is covered, from below upwards, by the subclavian vein, by those which come from the shoulder, by the external jugular, some nervous filaments from the cervical plexus, the sterno-mastoideus and the common integuments. It is along the external margin of the scalenus anticus that we carry the finger when we wish to find the subclavian artery, and upon its internal border that the phrenic nerve descends. It is this last border which transforms into a triangle the space which separates it from the longus colli muscle, and in which the vertebral vessels are situated.

We shall omit speaking of the other small muscles of the supra-

* The *Scalenus Posticus* embraces the *Medius* and *Posticus* of English anatomists.
—Transl.

clavicular region, such as the inter-transversales, etc., as they do not admit of any surgical application.

v. *The Arteries.*

(a) *The Subclavians.* They form two arches, the convexity of which looks upwards, and in order that their relations may be well understood, we will divide them into three portions; the first, within the scalenus anticus; the second between the two scaleni, and the third between these muscles and the clavicle.

In the first portion the two subclavian arteries must be examined separately.

The right subclavian is the thickest, shortest, and most superficial; it arises from the arteria innominata, opposite to the posterior and external part of the sterno-clavicular articulation, and afterwards passes almost transversely upon the first rib.

Its anterior surface is covered by the phrenic nerve, by pretty numerous filaments of the great sympathetic, and by the par vagum. All these nerves touch the artery, and cross it nearly at right angles. It is next covered by the subclavian vein which passes a little beyond it, during inspiration, in the *omo-clavicular* triangle; then by the internal jugular, which, as it is about to terminate in the preceding, is separated from the carotid by a small triangular space, in which we observe the artery under consideration, the par vagum and some filaments from the inferior cervical ganglion. The sterno-thyroid, sterno-hyoid, and the sternal portion of the sterno-mastoid muscles remove all these parts from the superficial sheet of the aponeurosis, and are themselves separated from the veins and artery by a very strong fibro-cellular lamina which is prolonged into the thorax upon the brachio-cephalic trunk.

Posteriorly, it is crossed by the recurrent nerve and some filaments of the great sympathetic. It rests upon the inferior cervical ganglion, and more deeply upon the longus colli muscle and the transverse process of the first dorsal vertebra, from which parts it is separated by adipose cellular tissue and some lymphatic glands.

Inferiorly, this artery is supported by the pleura and corresponds to the summit of the lung.

Superiorly, it is observed in the triangle formed by the scaleni and longus colli, and is there found in relation with the vertebral and inferior thyroid arteries, the first dorsal nerve, and several filaments of the great sympathetic.

The mere enumeration of the anatomical relations of the right subclavian artery on the inner side of the scaleni, is sufficient to show the danger and difficulty of applying a ligature around this portion of it. In fact, it would be necessary, in order to perform this operation, to cut the internal portion of the sterno-mastoideus, and frequently the sterno-lyoid and—thyroid muscles; then we would have to avoid, anterior to the artery, the vertebral, inferior thyroid and internal mammary vessels, the par vagum, phrenic nerve, etc.; posteriorly, the recurrent and great sympathetic nerves, and the superior intercostal artery.

The only means by which we can avoid all these parts, with the exception of the muscles, consists in dexterously dividing the fibrous sheath which envelopes the artery we are about to tie: for by this method all the nerves will be isolated, since they run in the lamellæ of this sheath. Still there would be an obstacle to the success of this ligature, in the origin of the inferior thyroid, vertebral and internal mammary arteries, which would interfere with the formation of the clot, if the thread was placed between these arteries and the scalenus muscle. The danger would not be less, if the ligature was applied so as to leave these branches on the acromial side; for then it would be too near the innominata and primitive carotid for the origin of the subclavian to be obliterated without exposing the subject to death from hæmorrhage.

On the left side this primary portion of the subclavian is longer, deeper and of smaller calibre; it descends almost perpendicularly upon the arch of the aorta; the subclavian vein crosses it as it passes towards the right; the par vagum and phrenic nerves are rather internal than anterior to it; the thoracic duct also crosses it, sometimes posteriorly and superiorly, at other times anteriorly and inferiorly, in its course to the vein into which it discharges itself. The carotid and left cardiac nerves run along its inner side; and, externally, it remains longer in relation with the pleura and lungs than the right subclavian.

It is important to note all these differences, as they shew us that it would be much less dangerous to apply a ligature here than

on the right side, because, being placed at a greater distance from the origin of the vessel, the adhesive clot would form without difficulty. It would likewise be easier in its execution, for the nerves do not cross it as on the right, but descend parallel to its direction into the chest, and might be readily separated. Nevertheless, it must be admitted, that almost all these advantages are counterbalanced by the greater depth and almost vertical direction of the artery.

The two other portions of the subclavian artery being perfectly similar on both sides, what we shall say of the one will necessarily apply to the other.

The subclavian artery, between the scaleni, is immediately applied, inferiorly, upon the depression in the first rib; posteriorly, upon the termination of the scalenus posticus; anteriorly, it is a little less approximated to the scalenus anticus, which is more internal than the posticus: which is owing to the curvature of the rib: superiorly and slightly posteriorly, we see the union of the first dorsal with the seventh cervical nerve; it is also covered or enveloped by fibro-cellular lamellæ of considerable thickness and density. It is in this point that we may compress it in two different ways, when we wish to suspend the course of the blood in the thoracic member; viz. either by pressing it from above downwards upon the first rib, which may be done with the thumb better than with any species of mechanical instrument; or from before backwards against the anterior part of the scalenus posticus and the transverse process of the first dorsal vertebra. In both cases the compression is rendered more easy and certain by depressing the shoulder; and, notwithstanding John Bell is of a contrary opinion, it is possible by this method to obliterate the calibre of the artery.* We cannot deny, however, that it will be difficult to accomplish this object when the clavicle and shoulder are very much elevated, and incapable of being depressed. Be this as it may, the disposition of the muscles is such that it is necessary to press the thumb from without inwards, from above downwards, and from before backwards, on account of the rib being inclined downwards and a little outwards.

* Anatomy, &c. vol. ii.

It is also in this point that the subclavian artery may be seized with the greatest ease and certainty; and in order to accomplish it, we must, after having lacerated or divided the different cellular laminae, carry the extremity of the index finger along the external margin of the scalenus anticus as far as its insertion into the first rib. Here, we must seek for the tubercle of this bone, which may always be felt; then by sliding the finger from this tubercle backwards upon the anterior part of the scalenus posticus, it will necessarily pass upon the artery. Nothing then is more simple than to raise this vessel, by passing under it an aneurismal needle, either from behind forwards, or from before backwards, always observing to apply the finger upon the point of the artery opposite to that under which the needle is introduced. This process is so sure that it would be possible to execute it without the aid of vision. But we should not forget that the artery is invariably the first cord which is met with behind the tubercle of insertion of the scalenus anticus muscle.

Between the clavicle and this last muscle, the subclavian artery is inclined considerably downwards, so that the nearer we approach the axilla the more difficult it is to reach it. In the first place it glides upon the first rib, then a little upon the second and the external surface of the scalenus posticus, and at length reaches the superior portion of the serratus magnus muscle. The inferior cord of the brachial plexus runs along its superior or external part, and usually passes before the artery as it enters the axilla. Anteriorly, this portion of the artery is covered by the subclavian vein, which sometimes ascends a little higher than the artery in the supra-clavicular hollow, near the scalenus, but inclines more and more downwards in proportion as it approximates the axilla, so that when it passes under the clavicle, the vein is internal, the nerve external, and the artery in the middle and posteriorly. In the next place it is covered anteriorly and superiorly by cellular tissue, some lymphatic glands, a venous plexus, the cervical aponeurosis, the platysma and the integuments.

This portion of the subclavian artery being included in the base of the *omo-clavicular* triangle, it is necessary, when we wish to apply a ligature around it, to draw outwards the *omo-hyoideus* muscle, after having divided its sheath; sometimes, indeed, we are obliged to cut across this small muscle. Finally, the opera-

tion should be performed as near to the scalenus anticus as possible, because in this point the artery is more superficial, more easily distinguished from the nerves, and less embarrassed by the other organs.

(*b*) All the other arteries of the supra-clavicular region are derived from the preceding; the vertebral, internal mammary and superior intercostal originate within the scalenus. The first was examined in the infra-hyoidean region; the other two appertain to the thorax. All that remain then to be shewn are the origin of the inferior thyroid, the ascending, transverse and deep cervicals, the supra-scapulary and sometimes the acromial arteries.

(*c*) The *thyroidea inferior* is a little more external than the vertebral, and is situated behind the sterno-mastoid muscle on the inner side of the scalenus anticus. It at first ascends parallel to the latter muscle, and after running about an inch, passes behind the carotid. It gives off,

(*d*) The *cervicalis ascendens*, which continues the primitive direction of the trunk, and soon applies itself upon the anterior part of the scalenus anticus, on the inner side of which it was inferiorly. It presents nothing interesting in a surgical point of view.

(*e*) The *Arteria Supra-Scapularis* is also occasionally given off from the trunk of the thyroid: it passes between the scalenus and sterno-mastoid muscles, then generally approximates the clavicle, the direction of which it follows; so that it might easily be wounded in seeking for the subclavian, if we did not proceed with the greatest caution. In its course to the coracoid notch of the scapula it crosses obliquely the nerves of the brachial plexus, and is crossed in its turn by the external jugular vein and the supra and sub-clavicular branches of the cervical plexus. When it originates from the subclavian external to the scalenus muscle, it usually gives off the acromial artery, which, in this case, immediately ascends upon the top of the shoulder.

(*f*) The *Arteria Transversalis Colli* likewise arises very frequently from the trunk of the thyroid; it curves outwards immediately after its origin, and passes in the supra-clavicular depression, making its way between the same muscles as the supra-scapulary, which it surmounts more or less. Passing transversely over

the phrenic nerve and the superior branches of the brachial plexus, it is crossed in its turn by the external jugular and several filaments of the cervical plexus, and runs sometimes below, at other times before the omo-hyoideus; it is covered by the fascia cervicalis, platysma and the skin; its course is tortuous, and of the two branches which terminate it in the posterior region of the neck, one passes before the levator scapulæ, the other between this muscle and the trapezius. It is seldom that this artery is situated so low down as to be in danger from the knife when laying bare the subclavian.

Finally, these secondary branches are of considerable importance in surgery in relation to the communications which they establish with the arteries of the shoulder, thereby supporting the circulation in the superior extremity after the principal trunk has been obliterated in the *omo-clavicular* triangle. If however the ligature is applied too near their origins, they may tend to turn off the column of blood and thereby prevent the formation of the adhesive coagulum.

VI. *The Veins.*

(a) *The Subclavian.* The disposition of this vein is not the same on both sides. On the left, it does not terminate on the inner side of the corresponding scalenus, but continues its course towards the posterior part of the opposite sterno-mastoid muscle, crossing before the left carotid, the trachea, the thymus, when it exists, and even the right carotid. It is this portion of the left subclavian vein which English anatomists call "*innominata*;" it receives the thymic, inferior thyroid, vertebral and internal mammary veins, etc., and is found situated immediately behind the supra-sternal notch, and the muscles which cover the posterior parts of the sterno-clavicular articulation.

In the next place, the subclavian vein of each side is at first separated from the fore part of the artery by the scalenus anticus; afterwards it approximates it, then becomes immediately applied upon this vessel, and at length, as it passes under the clavicle, it becomes quite internal or inferior to the artery. Anteriorly, it is covered by the origin of the sterno-thyroideus, the clavicle, and then by the subclavius muscle; its inferior side rests upon

the first rib, the costo-clavicular ligament and the superior surface of the subclavius muscle: superiorly, the subclavian vein is covered only by some cellular tissue; by different veins terminating in it, which we shall soon examine; by the aponeurosis and the fibres of the platysma; lastly by the skin.

This vein then might be easily wounded when we are about to expose its accompanying artery, especially as all the large veins swell out considerably, upon the living subject, whilst we are performing an operation of so great importance. It is true that some persons, Mr. Lizars* among others, have proposed applying a tourniquet upon the arm with the view of preventing this dilatation, by stopping the venous circulation in the limb; but, in addition to the inconvenience which such compression would produce in case of aneurism, we imagine that it would not accomplish the effect proposed, for the blood would still continue to flow into the subclavian through the jugulars and other veins of the neck and shoulder. Consequently, it is much better to content ourselves with favouring the inspirations, and pass the aneurismal needle from before backwards, and from below upwards, in order to be more sure of avoiding the laceration of the veins.

We should not forget that the thoracic duct empties into the left subclavian vein opposite to the point where the artery of the same name makes a curve in order to pass between the scaleni. This circumstance, in fact, renders the ligature of the artery, on this side, internal to the scaleni, much more dangerous than on the right. This circumstance was not overlooked by Dr. Colles when he applied a ligature on the right carotid in 1813;† but did not this surgeon exaggerate in saying that this operation was impracticable on the left? On the other hand, can we admit with Mr. Shaw,‡ that it would be preferable, in cases of aneurism, to amputate at the shoulder joint, than to tie the artery within the scaleni muscles? Reasoning from the anatomical disposition of the parts, we think that the extirpation of the arm would have no advantage over the ligature of the artery: besides, from the operation of Colles, that of Dr. Mott of which we will speak in another place, and analogy, induce us to believe, that, if the situ-

* System of Anatomical Plates, part 2d, page 70.

† Edinburgh Medical & Surgical Journal, No. 41, Vol. 2.

‡ Manual of Anatomy, page 337.

ation of the disease should require it, it would be much better to attempt this ligature than abandon the patient to inevitable destruction.

(b). *The External Jugular.* This vein passes obliquely, from above downwards and from before backwards, in the direction of the trapezius, and more or less anterior to this muscle. It originates by several branches in the parotidical region, and falls into the subclavian towards the middle of the supra-clavicular excavation, occasionally after having received the veins of the shoulder. As it descends it rests upon the sterno-mastoid muscle, which it crosses very obliquely; its course, on the contrary, is parallel to the direction of the fibres of the platysma, which covers it. From this relation it follows that, when we open this vessel, we should divide the platysma transversely to the direction of its fibres, as their retraction will enlarge the aperture and thereby admit of the free escape of the blood; whereas if the incision is made parallel to the course of these fibres, when they contract they will tend to close the opening.

This vein, towards the middle of its tract, generally passes near to the different branches of the cervical plexus, especially the ascending branches, which cover it or are covered by it upon the sterno-mastoid muscle; for which reason we should always endeavour to open this vein in its inferior half. In the supra-clavicular excavation it is separated from the deep-seated parts by the cervical aponeurosis, so that it is at some distance from the descending cervical nerves. It is not unusual, however, to see it approximate near to the omo-hyoidcus muscle, which it crosses at an acute angle. As it opens into the subclavian at a greater or less distance from the clavicular portion of the sterno-mastoid muscle, we are obliged, in order to discover the subclavian artery, after having cut through the integuments and platysma, to draw the external jugular vein either forwards or backwards, with a hook, and sometimes even to tie it in two places in order to divide it afterwards between the ligatures.

It is in this space that we compress it, when we wish to draw blood from it.

As it receives the most part of the external veins of the cranium, we conceive that it might almost directly unload the sinuses, through the medium of several emissary veins. From its com-

munication with the deep seated jugular we may account for the flow of blood being accelerated by the movements of the lower jaw ; and the reason why practitioners advise the retention of the breath while bleeding from this vein, is, that the blood may be forced to remain longer in the veins of the head and neck. Finally, during this operation, M. Larrey advises that the pressure below the orifice should not be removed until a compress has been applied upon the latter, otherwise, says he, the air might penetrate into the open mouth of the vein, and thus transform a slight operation into a wound suddenly fatal.

The external jugular vein is generally single in its inferior third portion ; sometimes, however, it is double or triple, in which cases its branches cannot be readily distinguished through the skin ; thereby rendering bleeding from the neck somewhat difficult.

(c) The *Collateral Veins*. In this region we find the ascending and transverse cervical, supra-scapulary, acromial, and, in some subjects, the termination of the cephalic. These veins almost always follow the direction of the arterial branches of the same name ; but they are larger and constantly more superficial. Generally, the two former open into the internal jugular, and the latter into the subclavian vein. Previous to terminating, or when they are about to terminate, they occasionally form a species of plexus external to the sterno-mastoid muscle and above the clavicle ; which plexus may, as Langenbeck has very judiciously observed, occasion great perplexity in the operation for securing the subclavian artery. To these we may also add some small veins which come from the thorax.

(d) The *Internal Jugular*. Its termination alone appertains to the supra-clavicular region. It is situated posterior to the sterno-mastoid muscle, external and anterior to the scalenus anticus, and at a little distance from the carotid. Between it and this artery there is a small elongated triangle, in which we usually observe the par vagum, phrenic and great sympathetic nerves ; externally, we perceived it in the hollow of the region ; on the left, it falls into the subclavian vein, a little internal to the point where the thoracic canal terminates, and is almost directly continuous on the right with the superior vena cava.

VII. *The Lymphatics.*

The absorbent vessels of the neck and shoulder, and a part of those of the exterior of the chest enter this region. We also find in it a very great number of lymphatic glands, which may be divided into those situated under the sterno-mastoid, behind the clavicle, and those which fill the supra-clavicular cavity. When the former become tumefied, they may be mistaken for an aneurism of the arteries in their immediate neighbourhood; the latter can seldom occasion mistakes of the like nature. The former will frequently compress the carotid, internal jugular and subclavian vessels; the latter will produce compression of the nerves.

VIII. *The Nerves.*

(a) The *Cervical Plexus* is almost entirely covered by the sterno-mastoid muscle, and lies upon the anterior and external portion of the scaleni. In the first place, we observe the ascending branches, one of which, the submaxillary, makes a turn from under the sterno-mastoid upon the external surface of this muscle, and soon enters the sub-hyoidean region: it is crossed by the external jugular. Another makes a similar curve, but ascends into the parotideal region: this is the anterior auricular. A third, which is the mastoid branch, runs perpendicularly behind this muscle, which at first conceals it, and thus rises to the summit of this region. The first anastomoses particularly with the portio dura (*facial*); the second with the facial, superficial temporal, and filaments from the frontal, and the third unites principally with the occipital.

The *spinal* (accessory) nerve is the most remarkable among the descending branches. It almost always perforates the sterno-mastoid from above downwards, descends between the levator scapulæ and trapezius muscles and ramifies in the latter. It constitutes the principal external respiratory nerve of Chas. Bell. We must avoid wounding it when we bleed from the jugular vein, or remove tumours from this region. It is always some-

what deeply situated behind the aponeurosis when it enters the trapezius muscle.

The *supra* and *sub-clavicular*, *supra-acromial*, *descending* and *deep cervical* filaments, diverge under the aponeurosis, between the trapezius and sterno-mastoid muscles, and are situated, for the most part, before the omo-hyoideus, but further back than the external jugular. We are obliged to divide several of them, in operating upon the subclavian artery, because it is difficult to isolate them, on account of the filamentous and dense cellular tissue which envelopes them.

(*b*) The *Phrenic*. This nerve requires particular attention in the performance of operations, in order that it may escape injury. It arises from the third and fourth cervical nerves, and seems occasionally to arise from the cervical plexus. It crosses the branches which go to the brachial plexus, and descends upon the anterior part of the scalenus anticus, buried under the sterno-mastoid muscle, on the outer side of the internal jugular vein. As it enters the chest, it passes between the subclavian artery and vein, opposite to the point of union of the first two portions of the latter vessel; so that this is one of the branches which would be most exposed in the ligature attempted by Colles. This nerve being the chief source of motion to the diaphragm, we conceive that its division, by suspending the contractions of this muscle, would greatly derange the respiratory function. It is the internal respiratory nerve of Chas Bell.

(*c*) The *External* or *Posterior Thoracic*. This cord arises from the posterior part of the fourth and fifth cervical branches anterior to the scalenus posticus, and terminates in the serratus magnus. It also enters into the system of the respiratory nerves of Chas. Bell.

(*d*) The *Nerves of the Brachial Plexus*. Included between the two scalmi, they are so arranged that the sixth cervical pair, as well as the cord resulting from the junction of the seventh with the first dorsal nerve, are separated from the others by the fleshy fasciculus (*Scalenus minimus* of *Sæmmering*) which passes from the posterior surface of the scalenus anticus to the anterior part of the costal extremity of the scalenus posticus. Hence it follows that the subclavian artery and the two first

cords are in a distinct space, in a complete triangle, the base of which is represented by the first rib; and that the other cords are not so much isolated, notwithstanding they are also included in a triangular space, the base of which is elongated and rests upon the anterior surface of the scalenus posticus. It has occurred more than once, that even skilful surgeons have applied a ligature upon one of the two first cords instead of the artery. This mistake may be avoided by recollecting that we always meet with the artery first in departing from the tubercle of the rib; that the first nerve is both more elevated and more posterior; that it rests upon the muscle, whilst the artery is actually in contact with the bone; that the artery is of a reddish pale colour and flattened upon the body which supports it; whilst the nerve is of a reddish white, harder, more cylindrical, etc. All these nerves approximate each other as they descend; so that at the moment they are about passing under the clavicle, they form a sort of bundle, the arrangement of which is not always the same. In this tract they are only separated from the summit of the thorax and the inferior part of the neck, by cellular tissue and some lymphatic glands. The levator scapulæ and omo-hyoideus run along their superior and external portion, the latter muscle being the most superficial. They are crossed by the supra-scapular and transverse cervical arteries and veins, and the external jugular; finally, they are covered by lymphatic glands and the descending nerves of the cervical plexus, by much cellular tissue, the aponeurosis, the platysma and integuments. On approaching the axilla, the most inferior cord, which was at first situated above and behind the artery, upon the first rib, at length places itself before this vessel, always remaining a little to its outer side. The sixth cervical pair also approximates close to this artery, and even touches it as it passes under the clavicle, when it is sometimes situated behind it.

The nervous cords which we have just examined, before they enter the cavity of the axilla, give off, besides the posterior thoracic, some other branches (the anterior thoracic nerves) which are generally distributed to the anterior part of the thorax. One of these branches, more constant than the others, should be particularly noticed: it is that which generally arises by two

roots, one of which passes behind, the other before the subclavian artery and unite, forming a species of loop, which we should be careful to exclude from the ligature applied upon this vessel.

(e) The *Par Vagus*. (Pneumo-Gastric.) Properly speaking, this nerve does not appertain to the supra-clavicular region until it is on the point of entering the cavity of the thorax. On the right side, previous to passing before the subclavian artery, it is situated opposite the vertebral vessels, which separate it from the anterior part of the transverse processes and the external portion of the longus colli muscle. It is separated from the trachea by the carotid, from the scalenus anticus by the jugular, is covered by the subclavian vein, by the root of the sterno-thyroid, sterno-hyoid, and sterno-mastoid muscles, then by the sterno-clavicular articulation. It is here that the inferior laryngeal (recurrent) nerve is detached from it, anterior to the artery, around which it makes a turn, so that it ascends from behind this vessel towards the œsophagus and trachea : this species of nervous circle would require the strictest attention, if we should attempt to tie the subclavian artery on the inner side of the scalenus.

On the left, the relations of the par vagum differ somewhat from those which have just been described. It is much more deeply seated ; it crosses the vertebral artery very obliquely, and places itself at its internal part ; it runs between the carotid and subclavian arteries without passing before the latter ; and lastly, it does not give off the recurrent until it reaches the arch of the aorta.

(f) The *Great Sympathetic*. Strictly speaking, the middle and inferior ganglia appertain to this region ; but it appears more proper to defer treating of the latter until we come to describe the cavity of the thorax ; and, as the former does not always exist, it is useless to take up our time in relation to it. We have then to speak only of the filaments which originate from these ganglia in order to form a species of plexus around the subclavian vessels. The most of these filaments proceed from the middle ganglion ; two or three ascend from the inferior, and all of them intermingle with the cardiac twigs of the superior ganglion, and with other filaments derived from the recurrent, etc. In this manner a complicated net-work is formed before and be-

hind the arterial trunk ; but the branches which collect to form this nervous interlacement are so small and numerous, that it is almost impossible to avoid wounding some of them in the attempt to lay bare the first portion of the subclavian artery. This læsion seems to be the principal cause of the accidents which follow the operation, on account of the disturbance which it must occasion in the functions of the heart.

IX. *The Skeleton.*

The skeleton of the supra-clavicular region is composed of the clavicle and first rib. These two bones leave between them a double triangular space with which it is of importance to be well acquainted. Thus, let us suppose the shoulder drawn very much backwards and elevated as much as possible, the plane of the triangle will be perpendicular ; that is to say, the clavicle will be superior and the rib inferior. But if the clavicle is very much depressed and at the same time brought forward as much as possible, the plane of this triangle will be horizontal. The apex of this triangular space is always at the sterno-clavicular articulation, and its base is represented by an arbitrary line drawn from the transverse process of the first dorsal vertebra to the posterior part of the clavicle, opposite to the coracoid process, and is naturally filled from within outwards, and from before backwards ;

(a) By the *costo-clavicular ligament*, which is so disposed that it promptly restrains the movements of the clavicle upwards and forwards, and which is separated from the subclavian artery only by a cellulo-adipose layer, generally of slight thickness ;

(b) By the *subclavius muscle*, which is prolonged upon the inferior surface of the clavicle almost to the point where this bone receives the insertion of the coraco-clavicular ligaments. Its superior surface is covered by a fibro-cellular expansion, which is afterwards spread over the vein, artery and nerves, and is finally lost in the cellular tissue of the supra-clavicular excavation. This lamina, which is attached to the whole extent of the posterior margin of the clavicle, is continuous on the other part with the costo-clavicular ligament ;

(c) By the *subclavian vessels and nerves* arranged in the

following manner: first the vein, next the artery which is more posteriorly; then the most inferior cord of the brachial plexus, slightly covering the anterior part of the artery; lastly the other branches of this plexus situated more externally and posteriorly. From this disposition it follows that the subclavian artery is covered almost entirely by the vein which is internal, and by a nerve which is external. Langenbeck, therefore, is in error, when he affirms that the artery is more superficial than the nerve: at least we have generally found its relations as just stated.

(*d*) More externally, this space is filled only by cellular tissue, fat, lymphatic glands, nervous filaments and vascular ramifications. It is through this part that morbid fluids, formed in the supra-clavicular region, beneath the aponeurosis, penetrate with the greatest facility into the axilla and behind the thorax.

As the artery and vein are fixed in the place which they occupy by the fibrous lamina indicated above, it follows that, in certain positions of the shoulder, these vessels may be so completely compressed as to obliterate their calibre. Thus, by pushing the shoulder downwards and forcibly backwards, the compression may be so firm as to suspend the circulation in the arm entirely, and every body knows that in this way we can immediately stop the pulsation at the wrist. There are some persons in whom this remark may be usefully applied in order to explain certain apparent anomalies of the circulation. For example, an individual may lie in such a manner that the weight of the body bears principally upon the anterior part of the shoulder; in which case the pulse might not be perceptible at the wrist. This circumstance would greatly embarrass the physician, if he did not reflect on this state of mechanical obliteration of the subclavian occasioned by the pressure of the clavicle and its muscle upon it. Such an occurrence has presented itself twice to our notice.

As the nerves pass through a wider part of the triangle, their compression must necessarily be less prompt and less complete. Nevertheless, when the bones are very much approximated, and continue so for some moments, a greater or less degree of numbness soon indicates that the nerves are compressed.

From what has just been observed, we find that these organs

will be the more free and will fulfil their functions better, in proportion as the shoulder is carried upwards and forwards; but we also see that, in this position, the artery will be at a greater depth, and consequently exposed with greater difficulty. Unfortunately it is most frequently in such cases that it becomes necessary to tie the subclavian.

In fact, aneurysmal tumours of the axilla, which do not admit of the application of a ligature anterior to the clavicle, never become much enlarged without pushing the shoulder in the direction just indicated. Otherwise, whenever the disease does not prevent it, we should always depress the shoulder, drawing it forwards. It is this position also which enables us to compress the artery against the first rib, if it could be adopted during the performance of the greater proportion of the operations which such compression requires, in amputations, for example.

It is proper to remark, that when this double triangle is forcibly contracted, (*that is to say, when the clavicle is carried very much downwards and backwards,*) the clavicle acts upon the first rib as a lever of the first order, and is only restrained from luxation forwards by the sterno-clavicular ligament. When, however, it is expanded (*the shoulder brought very much forwards and upwards*) the clavicle forms a lever of the second order, and then the costo-clavicular ligament as strongly opposes its luxation backwards as the ligaments which appertain to the articulation. We will resume the consideration of this subject when we come to treat of the sternal region, and will speak of fractures of this bone when describing the axillary region.

The first rib is important, as regards its anatomical dispositions, in several points of view. Its cartilage is broad, thick and very strong; it is also very short, and, if I may so say, incorporates the rib with the sternum. These are, here, so many elements of strength and resistance. Its vertebral extremity presents a rounded head, and not two plane articulating surfaces; its tubercle is not applied to the transverse process; the ligaments which connect this extremity to the spine are weaker, and less fibrous than those of the following ribs: here, these are so many elements of mobility, and it is this contrary arrangement of the two extremities of the first rib which has given rise to the opposite opinions of Haller and M. Magendie. The first of these physi-

ologists maintains that the first rib is almost immoveable, or at least that its mobility is comparatively much less than that of the other ribs, and thence concludes that it serves as a fixed point to the intercostal muscles during inspiration. M. Magendie, on the contrary, thinks that it is more moveable than all the others, and that it is elevated, during inspiration, like all those which are below it. It is not for us to decide this question; but we are of opinion that, whilst the strength of the cartilage and the shortness of the bone give weight to the idea of Haller, they do not prevent the mobility of this rib upon the spine, nor the elevation of the thorax *en masse*; so that if the first rib is actually the fixed point for the muscular actions, it must be so only through the medium of the scalmi muscles, the anterior especially.

In tracing this rib from the sternum towards the vertebra to which it is attached, its superior surface is at first broad, horizontal and very slightly elevated; the costo-clavicular ligament is attached to it obliquely from within outwards, and from the posterior towards the anterior margin: whence results a gutter circumscribed by the clavicle and rib, and excavated upon the posterior surface of the ligament, which then supports the sub-clavian vein and artery. Afterwards, this surface inclines slightly outwards and backwards, and presents, in this direction, a superficial depression, in which the vein lies. Behind this slight depression we observe the tubercle to which the scalenus anticus is attached, then the groove in which the artery is lodged. This tubercle is a little broader internally than externally, which is owing to this arterial groove being almost transversal, whilst the venous depression is oblique posteriorly. Here, the rib is a little narrower. Finally, the rest of this surface again becomes broader, rises, and resumes the horizontal position; it receives the attachment of a part of the scalenus posticus.

In the supra-clavicular region we penetrate through the following parts previous to reaching the first rib: 1st. The skin; 2d. a cellular layer of moderate thickness; 3d. the platysma, but in the anterior half of the region only; 4th. a thin lamellated cellular tissue, which supports the platysma, through which the external jugular vein and some nervous filaments take their course; 5th. the aponeurosis, which splits anteriorly and posteriorly in order to envelope the sterno-mastoid and trapezius mus-

cles; 6th. much cellular tissue, fat, lymphatic glands, the nerves of the cervical plexus, secondary veins and arteries; quite inferiorly, the subclavian vein, the omo-hyoideus muscle; 7th. the phrenic nerve, the scalenus anticus muscle; 8th. the nerves of the brachial plexus, the subclavian artery; 9th. the scalenus posticus and the bone.

ART. II. POSTERIOR PART OF THE NECK.

The posterior region, or nape, of the neck, is bounded; superiorly, by the occipital protuberance, transverse ridge and mastoid process; inferiorly, by a transverse line drawn from the superior angle of one scapula to that of the other along the cervical margin of these bones, and laterally by the supra-clavicular region, or a line dropped from the mastoid process upon the acromio-clavicular articulation.

This region is rounded and narrow in the middle; broader and projecting backwards, superiorly; plane and still broader inferiorly, and of various lengths and thicknesses in different subjects. These peculiarities generally depend upon its degree of prominence, the elevation or depression of the shoulders, and the developement of the muscles and other soft parts.

Upon its surface we observe, from above downwards, the external occipital protuberance, which is more prominent in some individuals than in others, and corresponds with the *Torcular Hierophili* within the cranium; below this, a triangular excavation, bounded laterally by an eminence occasioned by the complexi muscles. This hollow is called the pit of the neck, and is the place where issues are usually made: it is bounded inferiorly by the spinous process of the axis (*dentatus*). It corresponds to the space which separates the *os occipitis* from the atlas, and an instrument introduced through it might easily wound the *medulla oblongata*. More inferiorly we observe merely a simple furrow, and that only when the head is in extension; this furrow is the continuation of the preceding triangular excavation. The muscles likewise form an eminence on each side, but this is only seen when the furrow exists, and during their contraction. In the bottom of this furrow we with difficulty feel the spinous processes of the cervical vertebræ. At the most inferior part of the

region we see the spine of the seventh vertebra, which generally makes a very distinct prominence.

CONSTITUENT PARTS.

1. *The Skin.*

Its thickness is considerable, more so upon the median line and muscular eminences; a little less anteriorly or laterally; and its resistance is very great; which accounts for the agonizing pains attendant upon furunculous tumours developed in it. It is very elastic, almost inextensible, possesses but little vascularity, and is almost entirely composed of the fibrous element. It is to this predominance of the solids over the fluids, in the skin of the neck, that many attribute the infrequency of acute or chronic pustular affections, *dartres*, in short of cutaneous exanthemata in this region. This, however, is not the fact, for we observe herpes furfuraceus (*dartres furfuracées*), porrigo (*prurigo*), etc., as frequently in this situation as elsewhere. It is sometimes wrinkled transversely, especially in old people, and those who have lost much of their *embonpoint*. We do not observe papillary wrinkles upon it; but we frequently perceive in it points of a determinate figure, which correspond to the arcolæ of its internal surface. The hairs which cover the skin above, seldom descend lower than the dentatus; the rest of its surface is destitute of them. It does not contain many sebaceous follicles, at least they are distinguished with difficulty upon the median line. This skin generally becomes more adherent the lower it descends; nevertheless, it is commonly sufficiently moveable to allow us to pinch up folds of it of considerable thickness, when we wish to introduce a seton through it, and for this purpose the middle of the region is to be preferred, as well as on account of the dressings. When we wish to form an issue, however, we give the preference to the pit of the neck, because there is in this fossette a great quantity of cellular tissue; the form of it is very well adapted for the establishment of a drain; the cellular tissue passes directly upon the membranes of the encephalon; indeed, every circumstance seems to indicate that an issue, applied in this situation, will act much more efficaciously upon the brain and its meninges, than if established elsewhere.

II. *The Subcutaneous Cellular Layer.*

This layer is generally thin, formed of lamellæ and filaments, dense and firmly adherent to the skin, so that when we nip up a portion of the latter, in order to pass a seton needle through it, the cellular tissue is always included within the gripe. Those of its lamellæ which are nearest to the dermis contain numerous adipose cells, which sometimes form a cushion of considerable thickness. The other surface of this species of membrane is more uniform, and but loosely united to the aponeurosis; but it adheres pretty firmly to the ligamentum nuchæ (*cervical ligament*), with which it seems to be blended. It is in this layer that pus forms, in the erysipelatous inflammations of the posterior part of the neck. In these cases, the great thickness of the skin and its slight degree of extensibility afford much resistance to the fluid which tends to accumulate beneath it; hence it is that these abscesses are seldom circumscribed in a well defined manner, and that they promptly extend in different directions. It is with the view of avoiding the accidents which might result from the diffusion of these collections, that we are recommended to let out the morbid fluids so soon as they have formed. Unfortunately it is not always easy to seize upon the opportune moment; for generally, it is very difficult to detect the fluctuation. This cellular layer is usually dry, and encloses but a small number of vessels and nervous filaments.

III. *The Aponeurosis.*

In the supra-clavicular region we mentioned that the cervical aponeurosis separated into two sheets when it reached the margin of the trapezius. These two sheets again become blended upon the median line, after having enveloped this muscle. In thus terminating, they concur in the formation of the cervical ligament (*Ligamentum Nuchæ*), which, on the other side, is the common rendezvous of all the intermuscular cellular laminæ. In man, this ligament is reduced to a simple fibro-cellular band, which extends from the os occipitis to the last cervical vertebra, and unites the spinous processes of the neck to the skin. It consequently separates all the muscles of the right side from those

of the left. In quadrupeds, especially graminivorous animals, the cervical ligament is very strong and elastic: whence it follows that the head of these animals is naturally elevated, whenever the flexor muscles are in a state of relaxation. Upon the superficial lamina of this aponeurosis some nervous filaments from the posterior cervical branches ramify. This lamina is thin and firmly adherent to the trapezius muscle; but its external surface adheres but slightly to the subcutaneous layer: therefore nothing is more easy than to fold the skin of the posterior part of the neck, and comprise in the duplicature the cellular tissue which lines it, without running the risk of wounding the aponeurosis.

IV. *The Muscles.*

They are very numerous and arranged in strata. Some of them extend throughout the whole length of the region; others, on the contrary, only traverse it in part. Among the former, are,

(a) *The Trapezii.* These muscles are united at the median line by means of their aponeurosis, which grows broader as it descends, in order to form the fibrous rhombus (*losange fibreux*), the centre of which is at the spine of the seventh cervical vertebra. They form the first stratum, which is separated from the skin by the aponeurosis and subcutaneous layer only.

(b) *The Splenius cervicis et capitis*, which form a second layer, separated from the preceding by an aponeurotic lamina of considerable strength, and by a portion of the rhomboideus inferiorly. In passing towards the head, these muscles leave between them a triangular space, the apex of which corresponds to the middle of the neck, and in which the trapezius rests immediately upon the complexi. It is in the upper part of this space that the occipital artery disengages itself from beneath the splenii, in order to ramify under the skin of the cranium.

(c) *The Complexi** which form a third stratum, lying obliquely upon the subjacent layer. The minor complexus is external, and both are covered from below upwards by the rhom-

* The French anatomists describe two complexi muscles, the *major* and *minor*; the former M. Chaussier denominates *trachelo-occipital*; the latter, *trachelo-mastoidéin*.—*Transl.*

boideus, the serratus posticus superior, the splenii and trapezius. It is between them that the cervical ligament is situated. They are, moreover, composed of a great number of bundles, which are imbricated as they ascend from the transverse processes towards the median line; they cross the root of the splenii very obliquely, then pass over the transversalis colli, the terminations of the sacro-lumbalis and longissimus dorsi, over the semi-spinalis colli, and above the dentatus, over the obliqui et recti capitis postici.

Between these different muscular strata, we find nerves, vessels and cellular lamellæ. Between the trapezius and the second layer, the cellular tissue is dense, filamentous and very compact, superiorly; in the middle of the region it is lamellated, but still possesses considerable compactness; at its most inferior portion, it is much looser, and contains numerous adipose cells externally. Between the splenii and complexi the cellular tissue is sparing in quantity, except at the superior part, where it forms a layer of considerable thickness. Between the complexi and the muscles beneath them, it forms thin lamellæ in the two inferior thirds of the region; but in the superior third this element exists in great abundance, in the first place upon the median line between the complexi, then laterally, between the latter muscles and those which we are now about to examine.

The muscles which do not extend throughout the whole breadth of the posterior cervical region may be divided into two sets: those which lie above the axis, and those which are situated below it. The latter form a mass of greater or less bulk in different subjects, which completely fills the cervical gutters, and which is composed, in proceeding from the sides towards the median line, of the sacro-lumbalis, transversalis colli, longissimus dorsi and semi-spinalis colli; in a word, we find the prolongations of the different bundles which enter into the composition of the sacro-spinalis. They present nothing very remarkable in a surgical point of view.

The others are,

(a) The *rectus capitis posticus major*. This extends from the spinous process of the second vertebra to the inferior curved line of the os occipitis, external to the crest of this bone, and is separated from its fellow by a very narrow triangular space, filled

with a yellowish and dense cellular tissue: it is also separated from the great complexus by a very thick layer of similar texture, in which some nerves and vessels ramify. Externally, it is free and forms the internal side of a triangle which we will examine directly.

(b) The *rectus capitis posticus minor* passes from the tubercle of the atlas only towards the fossette which exists behind the foramen magnum, by the side of the median crest of the os occipitis. It is covered by the preceding, merely a thin lamina of cellular tissue being placed between them. It lies directly upon the occipito-atloldal ligament.

(c) The *obliqui* are so arranged that the inferior passes from the spine of the axis to the transverse process of the atlas, and the superior, from the latter tubercle to the os occipitis, between the two curved lines, near the termination of the rectus major: so that they form a very regular triangle, in which we observe several important organs, such as the vertebral artery, the suboccipital nerve, and a portion of the ligaments which unite the first two vertebræ to each other, as well as to the occipital bone. This space is covered by the great complexus, and filled with a fibro-cellular tissue, which adheres very firmly to the muscles, vessels, and nervous branches, and is united particularly to the periosteum and ligaments. The obliquus superior is concealed by the complexi, and rests upon the posterior inferior part of the os occipitis, between the splenius capitis, the great complexus, which are above, and the rectus capitis posticus major, which is below; finally, it lies upon the thinnest part of the inferior occipital protuberance; so that, if we should apply the trepan below the superior curved line, this small muscle would necessarily be divided. The inferior oblique is also covered by the complexi, and rests upon the two vertebræ to which it is attached, upon the posterior branch of the second cervical nerves, partially upon the vertebral artery, and upon some cellular tissue.

This region also contains two orders of small muscles: these are the inter-spinales and inter-transversales. The former are situated between the spinous processes, from the second vertebra to the seventh; between the atlas and dentatus (*axis*), between the os occipitis and atlas, the posterior recti appear to be substituted for them. They are double and symmetrical, and seem to

us to give support to an opinion which we might defend here, if the nature of this work permitted it; viz. that the yellow elastic fibrous tissue is susceptible of being converted into muscular tissue, according to the necessities of the organs between which it is situated.

The latter (*inter-transversales*) are arranged nearly in the same manner between the transverse processes, from the first cervical vertebra to the last. Between the first and the head, the *rectus capitis lateralis* supplies the place of the *inter-transversalis*. They are double likewise, and each circumscribe a small triangle through which the cervical nerves pass, but in such a manner, however, that these nerves cannot be compressed by the muscular contractions. Finally, they are there confounded with the insertion of a great number of other muscles; which are, posteriorly, the *sacro-lumbalis*, *splenii*, *complexi*, *transversalis colli*, *longissimus dorsi*, *semi-spinalis colli*, and more superiorly the *obliqui*; anteriorly, the *scaleni*, *angularis scapulæ*, *longus colli*, and the *rectus capitis anticus major*.

v. *The Arteries.*

All the arteries of this region come from the anterior part of the neck, and are, 1st. the horizontal branch of the *transverse cervical*, which ramifies principally between the first two muscular strata; 2d. the *cervicalis profunda*, which, in coming out from the space which exists between the two last cervical vertebræ, distributes twigs to the fasciculi of the vertebral gutters, then passes between this mass and the *complexi*, and terminates in the latter; 3d. The *ascending cervical*, which also gives off branches to the same parts, but exists in the superior half of the region only; 4th. the *occipital*, which is the most important, and requires attention. It originates from the external carotid, passes deep under the insertion of the sterno-mastoid muscle, between the axis and atlas, then under the *splenius capitis*, and enters the region under consideration; it next ascends in a tortuous manner upon the external surface of the great complexus, covered by the *splenius*, then by the *trapezius*, which it soon perforates in order to ramify in the subcutaneous layer. Sometimes it divides into two branches while it is yet under the mas-

toid process, in which case it would be almost impossible to apply a ligature around it; in other cases, however, this division takes place under the trapezius: then, if disease or accident renders the application of a ligature necessary, it might be discovered by dividing the skin, subcutaneous cellular tissue, aponeurosis, and by separating the trapezius from the splenius, from the transverse ridge of the os occipitis to the extent of two inches downwards. From this disposition, we perceive that a wound in the upper part of the neck might be followed by considerable hæmorrhage, whilst inferiorly there is no artery of sufficient volume to excite any apprehensions of this nature; 5th. the *vertebral artery* is sheltered from external violence, as far as the second vertebra, by its passing through the canal in the transverse processes; but in coming out from the third, it forms an arch with a posterior and external convexity, which is liable to be wounded by instruments penetrating to the spinal column. In the transverse process of the atlas, the vertebral artery curves forwards and outwards, and is again protected from external violence: as it issues from this vertebra in order to enter the cranium through the foramen magnum occipitale, it turns behind the condyle of this bone, upon the posterior surface of the posterior occipito-atloldal ligament, which it perforates, or rather derives from it a fibrous process, which is converted into a ring by the basiliary process of the os occipitis. It is here especially that the vertebral artery forms a very distinct curve, which is convex posteriorly, and that it is exposed for some time in the triangle heretofore noticed, when speaking of the oblique muscle. It is in this situation that it is most liable to be wounded. Previous to its entrance into the cranium, it gives off some small unimportant branches.

VI. *The Veins.*

They for the most part accompany the arteries, and empty into the internal jugular. There are some which are situated in the cellular layer beneath the skin, and terminate in the external jugular. The former also receive some emissary veins of *Santorini*, but they are so irregular and deep-seated, that they afford no special indication in relation to venesection.

VII. *The Lymphatics.*

Those of the superficial layer pass to the superficial cervical glands; the greater portion of the deep-seated, to the deep-seated glands of the neck; the remainder to those of the axilla. From these terminations of the lymphatics we may account for the tumefaction of the axillary glands and those of the infra-hyoidean region, in consequence of diseased affections of the posterior part of the head and neck.

We have occasionally met with two or three lymphatic glands upon the splenius, between the trapezius and sterno-mastoid, covered by the skin and cellular tissue, about one inch below the transverse ridge of the os occipitis. These glands sometimes become enlarged, and we should therefore recollect their seat in order that we may avoid mistaking such enlargements for tumours of a different nature.

VIII. *The Nerves.*

These are principally derived from the posterior branches of the cervical nerves; some from the cervical plexus, and the sub-occipital is chiefly distributed to this region. The former are situated, in the first place, between the splenius and complexus muscles; afterwards their branches separate, some of which pass between the complexi and the deep-seated mass, the others penetrate the fleshy strata which cover them, and all send filaments to the subcutaneous cellular tissue.

The second are the spinal (*accessory*), which ramifies in the trapezius; some filaments from the deep descending cervical branches, which pass into the same muscle, into the levator scapulae and the fibro cellular laminae which separate these two muscles from those which are beneath them. These are distributed to the inferior part of the neck only, and seem to appertain chiefly to respiration and sensibility. The preceding occupy the middle region, and are principally lost in the locomotive organs. There are also some other filaments from the auricular and mastoid branches of the cervical plexus, which are enclosed

within the laminæ of the aponeurosis, and terminate in the cellular tissue which separates them from the integuments.

The sub-occipital, which may be considered as the first cervical pair, is the most important nerve in this region. Having passed between the cranium and atlas, it enters immediately into the triangle circumscribed by the obliqui and the rectus capitis posticus major, enveloped in the cellular tissue which fills this space, and to which it is firmly adherent: here it divides into three principal branches, one of which, like the deep seated branches of the other cervical nerves, descends under the complexus and finally traverses it. The two ascending branches run towards the os occipitis, pierce the muscles or their interstices, anastomose with the superior twigs of the cervical plexus, between the aponeurosis and the skin, and with other filaments appertaining to the facial (*portio dura*).

From this disposition it follows that the nerves are most numerous in the *supra-axoidal* portion of the region; and this is doubtless the reason why inflammations of this part are attended with such acute pain. If to this we add the compact texture of the different tissues contained in it, we will understand why its inflammations are so liable to assume the erysipelatous character; why this species of inflammation is so readily developed in wounds of this part; why certain inflammatory tumours sometimes occasion such excruciating pain, and why pus, when secreted, is with so much difficulty collected in the form of abscess in this portion of the region.

IX. *The Skeleton.*

It comprises a great part of the os occipitis and the cervical portion of the spine.

That portion of the os occipitis which corresponds to the lateral sinuses and comprises the superior curved line, as well as the external protuberance, was noticed when treating of the occipital region, properly so called.

Upon the median line, we observe the occipital crest, which corresponds to a similar crest within the cranium, consequently to the falx cerebelli, and to the sinuses which this duplicature encloses. Into this crest the ligamentum nuchæ is inserted, and it

generally forms an eminence which is in a direct ratio to the muscular power of the individual. Laterally, we see the occipital bumps, which correspond to the inferior occipital fossæ and to the posterior part of the cerebellum. In this situation the bone is extremely thin, but it is covered by a thick cushion of the soft parts: nevertheless, fractures are not infrequent here, and are the more formidable on account of the difficulty of detecting them. These fossæ may be perforated by tumours of the dura-mater, by the pressure of the cerebellum, thus forming hernia cerebelli, two examples of which have been recorded by M. Prof. Lallemand and M. Baffos.* It is generally laid down as a rule that we should not trephine below the superior curved line of the os occipitis: however, if the indication was positive, we do not think that the operation would be very difficult or more dangerous than in other points of the cranium; only it would be necessary to apply the trephine upon the occipital bump, and not upon the median line, nor too near the superior curved line. It has also been said that fungous, or rather cancerous, tumours of the dura mater should not be removed, notwithstanding they may have perforated the cranium, and reasoning, as well as facts, seem to give support to this advice; but we think that it should not be too much generalized. It is indeed possible that a tumour of this nature may have made its way through the bone, without having extensively disorganized the dura-mater or encephalon. In such a case, we do not see why its extirpation should not be undertaken, especially if the progress of the disease will necessarily occasion the death of the patient.

This observation is strengthened by a fact which was recently presented to our notice; the pathological specimen has been deposited in the *Museum de la faculté*.

A woman died in Jany. 1825, at the hospital of *perfectionnement*, with a hard and immoveable tumour situated at the inferior and internal portion of one of the lateral occipital protuberances: this tumour, which was a scirrhous of the dura-mater, had perforated the bone. It was as large as a common nut, and the fibrous membrane was perfectly sound at half a line external to this morbid production. Now, it is evident that the extirpation

* M. Boyer, *Traité des maladies chirurgicales, etc.*, tome V. page 201.

of this cancer was possible, and that the operation would have afforded the same chances of success as would have attended a similar removal upon other parts of the body.

If it is true, as M. Gall affirms, that the organ of physical love resides in the cerebellum, wounds of the osseous portion, at present under consideration, would frequently be followed by changes in this propensity. It is from this idea that the celebrated author of the *Cranioscopie* says that we may be able to ascertain, from the distance of the mastoid processes from each other, and the separation of the lateral eminences of the os occipitis the strength or weakness of the instinct of reproduction in different individuals.

The vertebral column presents several remarkable peculiarities in this region :

(*a*) It is concave, and this concavity is in a direct ratio to the age.

(*b*) The spinous processes are of unequal lengths: thus the first vertebra has none, for which reason the head may be thrown backwards with greater facility; the spinous process of the second is thick and very long; that of the third very short, and the following gradually increase to the seventh; so that, from the dentatus (*axis*) to the last cervical vertebra, there is a notch which is mostly filled with soft parts; which notch should induce us to select the middle of the neck for the introduction of a seton. These processes are almost horizontal, and consequently quite remote from each other, a disposition which admits of much latitude of motion.

(*c*) The transverse processes are also very short; their length gradually decreases from the seventh and from the first towards the third: the extent of motion which the neck enjoys is a natural consequence of the shortness of these processes. Through their base passes the canal for the transmission of the vertebral artery, which is thus protected against the action of foreign bodies. Nevertheless, we are of opinion that a sabre, or other cutting instrument, struck against the side of the neck with a certain force, might reach these vessels and occasion a wound which would be dangerous, both on account of the difficulty of securing the vertebral artery, as was shewn in the *infra-hyoidean region*. and of distinguishing whether the carotid or vertebral has

been divided. The nerves pass out behind the artery, and divide on the external side of it.

(*d*) The facets of the oblique articulating processes approximate more to the horizontal direction than in the other regions; nevertheless they incline more and more in descending from the inferior *facets* of the second to the seventh; so that their displacement is more difficult to accomplish in proportion as they remove from the axis. This displacement, or luxation of the cervical vertebræ below the dentatus, admitted by some, but denied by others, is certainly possible: we now possess incontestible examples of it. If only one *facet* passes before the other, without lacerating the intervertebral cartilage, the luxation is incomplete, and may exist without paralysis; but if the four surfaces have abandoned each other and the fibro-cartilage is torn, the spinal marrow is compressed, paralysis immediately occurs, and even death. It is especially between the atlas and second vertebra that the arrangement of these surfaces is worthy of attention. Here they are plane, horizontal, or slightly inclined outwards. On the other hand, the atlas has no plates, properly so called, no spinous process, no body; consequently, no ligamentum flavum nor fibro-cartilage. Hence it follows that the movements naturally exist in all directions, that rotation may be carried very far without danger; but, should it pass beyond the quarter of the circle, luxation will inevitably ensue, because then one of the *facets* of the atlas passes before, and the other behind those of the axis. We should particularly recollect the possibility of this accident during the tractions which we exercise upon the body of the infant in parturition, when we operate by turning. In fact, if, for example, the face is placed anteriorly and the accoucheur endeavours to turn it towards the sacrum; for this purpose he gives the trunk a slight turn at each traction which he executes; and, if he only considers the form, it would not be very difficult to place the back of the fœtus towards the pubes. But if the head has not followed the movements communicated to the trunk, if it has remained in the position which it occupied at the commencement of the manœuvre, a luxation of the first two vertebræ will be produced, and the death of the infant will precede its extraction.

(*e*) The union of the head with the atlas, and also with the

axis, deserves particular attention. The condyles of the os occipitis being convex, elongated and directed obliquely outwards and backwards, the superior facets of the vertebra upon which they rest being adapted to this disposition, an articulation is the result which admits only of flexion and extension; but as the *occipito-atloldal* ligaments are supple and broad, as the posterior arc of the vertebra is thin and destitute of a spinous process, this double movement may be carried pretty far, less so, however, than we would be induced to believe at the first glance, because the odontoid process and its ligaments prevent the atlas from being carried forwards. The rotary motion is principally executed upon the odontoid process and the articular surfaces of the (*axis*) dentatus. As we examine these parts from before backwards they thus present themselves: 1st. the anterior arc of the atlas and the ligament which unites it to the os occipitis; 2d. the odontoid process and ligaments; 3d. the transverse and occipito-axoidien ligaments; 4th. the dura mater; 5th. the spinal canal filled with the medulla.

The odontoid process forms a species of pivot around which the atlas turns: attached to the inner side of the condyles of the os occipitis by two short fibrous bundles, it cannot press upon the marrow without previously rupturing the transverse ligament of the first vertebra, unless it should slip from under it, in which case the odontoidal ligaments must necessarily be previously lacerated. We are of opinion that, in order to produce this effect, in either of these ways, considerable force is required. It nevertheless appears that those who have been hung frequently died in this manner; but more frequently the ligaments of the odontoid (ligamenta moderatoria) were first broken and this process had afterwards escaped from its ring below the transverse ligament of the atlas, and entered the spinal canal, so as to lacerate the medulla, causing instantaneous death: sometimes also the transverse ligament was broken and death had taken place in the same manner.

In children, slighter efforts will produce the same effect. In them, the vertical process of the second vertebra is but slightly developed; its ligaments are much less unyielding; the ring which encloses it is less close; the transverse ligament also possesses a certain degree of elasticity; so that this process might

escape from beneath the latter band, without lacerating its proper ligaments. These are the different peculiarities of these parts in youth, which enable us to comprehend how, by raising a child from the ground by means of the hands placed on each side of the head, we might cause his immediate death, if he should make any struggles to disengage himself from our grasp. A case of this kind is related by J. L. Petit.

We may also remark that the first two cervical vertebræ are so articulated, so connected with each other and with the head, that an instrument or weapon might easily be thrust into the spinal canal, without dividing any but soft parts, and occasion instant death by the injury inflicted upon the superior part of the spinal marrow. Thus if a small sword is thrust into the *fossette* of the neck, it would possibly penetrate the *occipito-atloidal* (*infundibuliforme*) or *atloido-axoidien* ligament, and cut through the commencement of the medulla spinalis. It was in this manner that the man who destroyed the child spoken of by J. L. Petit, was himself killed by the father of this child, if we can give implicit credence to the statement of these two cases.

This disposition seems to be well known to butchers, since they frequently strike down animals by plunging a knife behind the os occipitis; also by common people, who know that if a needle is thrust into this region, death will be the consequence; and malefactors have more than once profited by this knowledge, in order to perpetrate the worst of crimes, upon young children especially. If the instrument was introduced at the anterior part it would not be attended with the like danger, because the odontoid process of the axis would prevent its reaching the medulla.

Below the second vertebra, wounds of this kind can no longer take place. All these bones, in fact, so overlap each other as to form a complete canal, the parietes of which present no open space for the transmission of foreign bodies.

Be this as it may, it is proper to recollect that a wound of the medulla between the first vertebra and the os occipitis, would leave untouched the roots of the par vagum, glosso-pharyngeal, and ninth pair; but that all the other nerves, the sub-occipital excepted, would be thus separated from the encephalon between

the first two vertebræ. Between the second and third, a portion of the cervical plexus would remain; between the third and fourth the whole of this plexus would escape, as well as the spinal accessory, one or two roots of which only would be destroyed. Between the fourth and fifth, the phrenic nerve would be saved, and the brachial plexus in part respected; lastly, more inferiorly, paralysis of the superior extremities will not necessarily ensue.

The head is so balanced upon the summit of the spine that it represents a lever of the first order, the anterior arm of which would be longer than the posterior. Hence it follows that the head is disposed to preponderate anteriorly, and that the chin naturally approximates the sternum during rest or sleep.

During parturition, it is this unequal length of the moveable lever which the head of the child forms, that disposes this part always to advance first, when there are no particular obstacles to prevent it. In fact, in this case, the vertebral column, which represents the power, bears more towards the occiput than the chin; consequently, when the lever is brought into play, this is the first part that must descend. During life, the anterior arm of the lever sometimes constitutes the power; at other times, it is the posterior arm which represents it. In both cases, there are muscles applied upon the whole length of these arms, so that they may be lengthened or shortened, according to the demands of nature.

Considered transversely, the head again represents a lever of the first order; but then the point of support is exactly in the middle of its length. On the other hand, the lateral movements not existing in one articulation solely, but being executed at the expense of the whole at the same time, it becomes, in this respect, much less interesting than the former.

CHAPTER III.

OF THE THORACIC EXTREMITIES.

In the thoracic extremities we will examine successively, 1st. the shoulder; 2d. the arm; 3d. the elbow; 4th. the forearm; 5th. the wrist; 6th. the hand.

ART. I. OF THE SHOULDER.

We divide the shoulder into an anterior, or thoraco-humeral region ; and a posterior, or scapulo-humeral region.

Sect. 1. The Thoraco-humeral, Subclavian, or Axillary Region.

The axillary, or anterior region of the shoulder, is the most important of the superior extremity. It is bounded, superiorly, by the supra-clavicular region ; inferiorly, by the free margin of the pectoralis major ; externally, by a line which would fall perpendicularly from the apex of the acromion upon the free extremity of the thumb, in the direction of the external border of the limb, which line we will call *acromio-digital* ; and internally, by another line, drawn from the clavicle, one inch external to the sternoclavicular articulation, in order to terminate upon the anterior and superior spinous process of the os coxal (*ilium*), and which we will call *clavi-coxal*.

The surface of this region presents, superiorly and externally, a spherical prominence which corresponds to the anterior part of the head of the humerus ; on the inner side of this convexity, a broad and superficial groove which corresponds to the hollow of the axilla. This groove, more strongly marked in emaciated individuals, increases in depth when the arm is approximated to the trunk, and presents several points worthy of consideration. Superiorly, we observe a triangular depression, by which we may easily penetrate into the articulation. If we apply the thumb upon this space, we will feel that it is limited, externally, by the head of the humerus ; internally, by the coracoid process, and superiorly, by the clavicle and acromion. It is at this point that MM. de Champesmes and Lisfranc have proposed introducing the knife for the purpose of amputating the arm at the joint.

Below this groove we meet with the anterior margin of the axilla, a species of rounded arch, with its concavity directed downwards, when the arm is pendent ; but straight and tense, when elevated ; it is of considerable thickness in corpulent subjects ; very thin, and sometimes almost cutting, in those who are emaciated.

Behind this border, we find an excavation, which is increased in depth as the arm is lowered, and becomes more superficial in proportion as it is raised. This excavation is triangular, with its base resting upon the thorax; it is bounded posteriorly by another border similar to the preceding, which is formed by the anterior portions of the *teres major* and *latissimus dorsi* muscles: this is the posterior margin of the axilla. If we pass the fingers into the axilla, we may feel through the skin, when the subject is not very fat, the lymphatic glands, the head of the humerus, the nerves of the brachial plexus, and sometimes even the pulsations of the humeral artery.

CONSTITUENT PARTS.

I. *The Skin.*

It does not possess the same characters throughout the whole extent of the region. At the anterior part of the shoulder it is thick and less extensible than before the axilla, where it is generally delicate and very supple. The fibrous tissue which enters into its composition is more compact in the first direction than in the second, and there also the sebaceous follicles are larger and more numerous. Inferiorly, in the cavity of the axilla, it is much more delicate still, very extensible, of a browner colour than elsewhere, covered with hairs which never acquire a great length, which are more abundant in the male than in the female, and are not developed until after puberty. The skin in this situation contains a great number of large follicles, which secrete the unctuous matter usually found in the axilla. This matter is more or less abundant in different subjects; sometimes it gives out a very strong odour, especially in persons of a fair and ruddy complexion. At other times, it is so corrosive that it injures the linen, and produces excoriation of the skin which it is intended to lubricate.

II. *The Subcutaneous Layer.*

Fat, cellular tissue, vessels and nerves enter into the composition of this layer.

The adipose vesicles are very large, and may acquire a considerable development; they are more abundant in the anterior than the inferior part of the region, and may form an extremely thick cushion. In proportion as they become filled, they separate the lamellæ of the cellular tissue, which approximate, on the contrary, when the cells become empty: whence it follows that in fat individuals the cellular tissue appears scattered, whilst in those who are thin it forms a distinct lamina of considerable strength. The cutaneous surface of this lamina is uneven and filamentous: it is this which supports the adipose vesicles; the other surface is lamellated, smooth, and does not adhere very firmly to the aponeurosis; the vessels, especially the veins, ramify in the sheets of this deep surface; whence they are scarcely perceptible in fat individuals. In some persons, the subcutaneous veins occasion *vergetures* (*stains*), quite strongly marked upon the skin. It is also in this layer that the cephalic vein takes its course. In the cavity of the axilla, the cellular tissue is blended with the aponeurosis, and encloses several lymphatic glands in its areolæ.

III. *The Aponeurosis.*

We may consider it as originating from the arm. In fact, the *fascia brachialis*, below the pectoralis major and latissimus dorsi, is distributed in the following manner: with regard to the pectoralis major, one layer passes before it, and thus ascends, under the form of a simple cellular sheet, upon its anterior surface, and over that of the deltoid muscle, in order to attach itself to the clavicle. This lamina also penetrates into the *coraco-clavicular* triangle, and thereby reaches the fibrous capsule of the articulation; it adheres firmly to the muscular fibres, and, as it is thin, it is not always easy to separate it from them. Externally, it may be readily distinguished from the subcutaneous layer. It is important to make a distinction between those abscesses which form without this lamina and those which are situated beneath it: the former have a constant tendency to point at the surface, and are not more dangerous than in the extremities; the latter, on the contrary, are very liable to penetrate into the cavity of the axilla, if they are not there already, and in this case we know what a variety of accidents they may occasion. Another aponeurotic lamina glides

behind the pectoralis major muscle, lines its posterior surface, is thicker and stronger externally than internally, but soon becomes converted into cellular tissue.

The same disposition exists in relation to the latissimus dorsi; except that the posterior sheet is the strongest, as we will find in the posterior region of the shoulder. The layer which passes before this muscle is also at first of considerable strength, but becomes thinner as it ascends, so that soon a simple lamella only remains which goes to the posterior surface of the pectorales, after having covered the free surfaces of the subscapularis and serratus magnus; which is at length interposed between all the muscles, its different laminæ afterwards uniting together at the upper part of the cavity of the axilla, so as to form a more compact aponeurosis before the vessels, the brachial plexus, and the subclavius muscle. The cellular tissue, properly so called, seems to result from the unfolding of the aponeurosis, as it passes from one margin of the axilla to the other. It consists of an assemblage of plates and filaments which are continued without interruption as far as the scapulo-humeral articulation, with which it contracts the most intimate union. This cellular tissue is also prolonged behind the clavicle, into the supra-clavicular region, and likewise forms a communication between the axilla and the posterior region of the neck, by means of the space which exists between the trapezius, angularis and the second muscular stratum of this region. By this train we may explain the reason why the axillary region is, as it were, the common rendezvous of all the suppurations which take place in the spaces just indicated.

IV. *The Muscles.*

(a) *The Pectoralis Major.* This muscle is separated from the skin by the aponeurosis, superficial layer, some vessels and nerves: it lies successively, from above downwards, upon the subclavius muscle, from which it is removed by a fibrous lamina indicated above, and by a cellulo-adipose cushion of greater or less thickness; upon the subclavian vein and artery, and upon the nerves of the brachial plexus, from which it is separated by venous, arterial and nervous branches of considerable magnitude,

and especially by a very thick layer of cellular tissue; upon the pectoralis minor, below which it again rests, but in a less direct manner, upon the axillary vessels and nerves. Its fibres converge from the clavicle and ribs upon the humerus; so that it is possible to reach the vessels by simply separating the fleshy fasciculi without dividing them. This advice, which was first recommended by Prof. Marjolin,* and in a vague manner by several surgeons, is now generally adopted when it becomes necessary to tie the axillary artery. In order to follow it, it is sufficient to make an oblique division of the skin, superficial layer, and aponeurosis of the internal boundary of the region, beginning the incision at the clavicle and extending it to just below the coracoid process, that is to say, parallel to the direction of the fleshy fibres. This process is undoubtedly preferable to that which consists in making a semilunar flap of the integuments upon the fore part of the clavicle,† and still more so than that of cutting across the tendon of the pectoralis major.‡ In the latter case, in fact, even admitting its success, we see that the drawing down of the arm and full inspirations would be liable to be greatly impeded. By its insertion into the anterior lip of the bicipital sheath, the pectoralis major muscle there constitutes a solid barrier which prevents the long head of the biceps from escaping before the gutter in which it is lodged. There is a groove of greater or less depth, commencing from this insertion, which separates it from the deltoid; this groove, which we might call *coraco-deltoidal*, is broader above than below; it is filled by adipose cellular tissue, the cephalic vein, and the descending branch of the acromial artery; it is also traversed, quite near the clavicle, by the transverse branch of this artery; finally, the coracoid process is usually found deeply seated in its superior portion.

(b) The *Pectoralis Minor*. Extended from the coracoid process upon the external surface of the second, third, fourth, and sometimes fifth ribs, it crosses almost at a right angle the posterior face of the pectoralis major, being separated from it by a cellular-adipose layer of considerable thickness, in which some vessels of a certain magnitude are imbedded. Its poste-

* Dictionnaire de Médecine, article Anévrisme, etc.

† Hodgson, Diseases of the Arteries, etc.

‡ M. Roux, Médecine Opératoire, &c.

rior surface crosses the axillary vessels and nerves in such a manner, that we may reach these vessels, both above and below this muscle without dividing it. Its superior margin forms the base of a very important triangle, which we call *clavi-pectoral*. The other sides of this space are represented by the anterior part of the clavicle, on the one hand, and by the upper part of the *clavi-coxal* line, on the other. The first of these margins measures, in a subject of the middle stature, the arm being slightly extended, five inches; the length of the second, beginning at the internal border of the coracoid process, three inches and a half; and the last, which extends upon the third rib, three inches only. In this space we observe, from the chest towards the arm, some lax cellular tissue, the axillary anterior thoracics and cephalic veins, the axillary and acromial arteries, the nerves of the brachial plexus and the anterior thoracic nerves; superiorly, the subclavius muscle. It is in this triangle that the artery may be most readily tied, and we may reach it by tracing the superior border of the pectoralis minor. We will recur to this again.

Below this muscle, the pectoralis major conceals another triangle, which is larger than the preceding, but its inferior side does not, strictly speaking, exist, since it would be formed by the anterior margin of the axilla. It would consequently extend from the humerus to the sixth rib, and its length would be about five inches. Its external border is formed by the humerus, and is three inches and a half long; its superior side is three inches, and is represented by the pectoralis minor. We will call it *sub-pectoral*.

In this triangle we observe a great abundance of cellular tissue, and from within outwards, lymphatic glands, the basilic and axillary veins, the axillary artery enveloped by the nerves, a portion of the coraco-brachialis muscle, the tendons of the latissimus dorsi and teres major, finally, a portion of the biceps. In this situation the vessels and nerves run nearer the arm, whereas in the *clavi-pectoral* triangle they lie nearer the thorax.

(c) The *Deltoid*. A little less than the anterior third of this muscle appertains to this region. It forms the fore part of the shoulder and the prominence noticed when speaking of the surface: it there forms a species of concavity in which the anterior part of the articulation is encased. It is separated from the pec-

toralis major by the *coraco-deltoidal groove*. Its fibres descend almost perpendicularly; which should be recollected when we wish to make deep incisions in this part of the region. This portion of the deltoid forms a triangle, which, when removed, exposes a similar space, in which we see the tendon of the pectoralis major, surmounted by a fibrous prolongation which is continuous with the scapulo-humeral capsule, and receives below the brachial aponeurosis; under this tendon, the bicipital sheath, and the tendon which it encloses; anteriorly, the anterior part of the humerus, the two branches of the anterior circumflex artery; more superiorly, the two tubercles of the os humeri, and the tendons which are inserted into them; still higher, another small triangle* formed anteriorly by the coraco-acromial ligament; posteriorly by the external fourth of the clavicle and the apex of the acromion; internally, by the coraco-deltoidal line or by the coracoid process. It is at this last space that MM. Champesmes and Lisfranc recommend the knife to be introduced in order to amputate the arm at the articulation.

(d) The *Subclavius*. The superior face of this muscle was treated of in the supra-clavicular region; at present we have to examine its anterior portion only. It advances more or less into the axilla, according to the degree of depression or elevation of the shoulder, and is covered by a fibrous lamina, to which it gives origin, or is united. This lamina, which was noticed when speaking of the aponeurosis and cellular tissue, is attached to the anterior part of the clavicle, to the coracoid process, is continuous with the coraco-humeral ligament, and through it to the brachial aponeurosis. It descends upon the fore part of the axillary vein, upon which it seems to be counfounded, and is continuous with the cellular sheath of the vessel. It is also prolonged upon the artery and the nervous bundle of the brachial plexus, but is soon lost in the cellular tissue of the axilla. This aponeurosis is of considerable strength in some individuals, especially before the vein, and is one of the laminae which perplex us most when we wish to isolate the axillary artery in order to apply a ligature around it.

(e) The *Coraco-Brachialis* and the short portion of the biceps originate in common from the coracoid process but soon sepa-

* *Coraco-acromien.*

rate, so that the biceps passes before the tendon of the latissimus dorsi, whilst the coraco-brachialis descends obliquely backwards and outwards.

(*f*) The *Subscapularis*. The anterior surface of the teres major and of the anterior border of the latissimus dorsi, here form the posterior paries of the arm-pit. Between the teres major and subscapularis there is a space, which enlarges as it approximates the humerus. This space is converted into an aperture almost quadrilateral, which is circumscribed above by the anterior border of the scapula and the subscapularis, by the teres major below, posteriorly by the long head of the triceps, and anteriorly by the neck of the humerus. This opening is filled by cellular tissue, and through it the axillary artery and nerves pass.

(*g*) Lastly, the *serratus major anticus*, which attaches the shoulder to the chest, and seems to unite the spinal border of the scapula to the posterior surface of the pectoralis major. It conceals the intercostals, and forms the internal paries of the axillary cavity.

It may now be readily perceived that all these muscles surround a triangular pyramidal cavity, the base of which is inferior and formed solely by the aponeurosis and skin, and its apex, filled with cellular tissue merely, situated in the posterior part of the supra-clavicular region. Its anterior paries comprises the pectoralis minor, the *clavi-pectoral* and *sub-pectoral* triangles, and is formed principally by the pectoralis major. Besides the subscapularis, teres major and latissimus dorsi, the posterior paries also includes, in part, the anterior surface of the coraco-brachialis. The serratus major anticus constitutes almost the whole of the internal wall, which is completed by the intercostal muscles and ribs.

The internal and posterior parietes unite, forming an angle somewhat acute, upon the posterior margin of the scapula. As this angle is completely closed, pus cannot infiltrate from the axilla into the dorsal region without perforating the serratus major. The angle which results from the union of the internal and anterior parietes is still more acute; it is prolonged upon the anterior part of the thorax, and affords but a feeble opposition to the infiltration of pus or other morbid fluids in this direction. The external angle is truncated superiorly; it includes a portion of the

coraco-brachialis, the humerus and the internal part of the scapulo-humeral articulation. It is the anatomical disposition of this side which permits us to compress the axillary artery in this angle.

v. *The Arteries.*

(a) The *Axillary* is the principal trunk of this region, and gives origin to all the branches contained in it. This artery is the continuation of the subclavian; it obtains the name of axillary from the clavicle as far as the posterior margin of the axilla, that is to say, of the latissimus dorsi. Its direction is oblique from above downwards, and from within outwards. It becomes smaller and smaller as it descends, which is owing to the branches given off by it. Superiorly, it is situated nearer to the thorax; inferiorly, on the contrary, nearer to the arm; whence it follows that wounds penetrating the cavity of the axilla will be less liable to injure the artery if they approximate the chest; whereas if an instrument should penetrate the upper part of this region, from before backwards, the nearer it approximates the arm the less would be the risk of wounding this vessel.

The general relations of the axillary artery are the following: internally and anteriorly, are found the vein and its principal branches, some lymphatic glands, and cellular tissue, the serratus magnus, aponeurosis and the skin; externally and anteriorly, the nerves, subscapularis muscle, tendon of the latissimus dorsi, the articulation and the humerus; anteriorly, the artery is covered by the nerves, veins, lymphatic glands, fibro-cellular layers, the subclavius, pectorales and coraco-brachialis muscles, and the integuments; posteriorly, we see some nervous branches, much cellular tissue, the subscapularis, teres major and latissimus dorsi muscles. But, in order that we may render these relations susceptible of practical applications, we will adopt Dr. Harrison's plan of dividing the axillary artery into three portions.*

(b) In the first portion, which extends to the superior margin of the pectoralis minor, the great axillary vein is on the inner side of the artery, and upon a plane which is anterior to it; so

* Surgical Anatomy of the arteries, Vol. I, page 157.

that it usually covers it so much, upon the living subject, that it is indispensable to draw it still more internally when we wish to tie this artery. Behind the vein, the axillary artery rests in the first place upon the first intercostal muscle, the second rib, and afterwards upon the cellular tissue which covers the first portion of the serratus major anticus.

On its acromial side runs the inferior branch of the brachial plexus, which inclines more and more before it. All the other nerves remain more posteriorly and external to it. Still more externally we observe the cellular tissue of the summit of the axilla, then the coracoid vault.

Posteriorly, it rests, as it comes out from the supra-clavicular region, upon the first rib, a little upon the second, after which its posterior surface is free in the cellular tissue and is situated before the nerves.

Finally, considered anteriorly, this portion of the axillary is included between the vein of this name and the nervous cord resulting from the union of the first dorsal with the seventh cervical, so that at its most inferior part it is concealed by these two organs, whereas we sometimes see it pretty distinctly, in its superior portion, without separating them. The subclavius muscle, in crossing it, descends upon it for about the space of half an inch below the clavicle. A little lower, it is usually surmounted very obliquely by an anterior thoracic nerve which passes between the two pectorales, and which might easily be wounded or comprised in the thread which we place upon the artery. Anterior to these parts there are some dense cellular laminæ, and especially the fibrous sheet which passes from the coracoid process to the clavicle and upon the cartilage of the first rib, a sheet which we will call the *coraco-clavicular aponeurosis*. This lamina, which, as we have already noticed, is continuous with the aponeurosis of the arm by means of the cellular tissue of the axillary cavity, sometimes presents upon the fore part of the vessels a kind of semilunar border, the concavity of which looks downwards and inwards. Next to this fibrous sheet, the axillary artery is separated from the skin by an adipo-cellular layer of more or less thickness, by the pectoralis major, the aponeurosis which covers it, and the subcutaneous texture. It here divides the *clavi-pectoral triangle* into two nearly equal parts, and its direction

follows that of the *coraco-deltoidal groove*, so that by cutting upon this groove we fall upon the artery, or on the outer side of it.

In order to tie this vessel in the space just mentioned, the incision, which was directed when speaking of the pectoralis major muscle, being made, and the limb being approximated to the trunk, in order to relax the fleshy fibres, we should separate the lips of the wound. Then the cellulo-adipose layer, enclosing several arterial, venous and nervous branches, presents itself; which should be divided with the greatest caution. This layer being laid open, we see the superior margin of the pectoralis minor, which may easily be drawn down; afterwards the prolongation of the coraco-clavicular aponeurosis is met with, which, if cellular merely, may be torn with the grooved director, but, if stronger, we should first pierce it with the bistoury and afterwards enlarge it upon the director. This being done, all that is required is to isolate the artery and pass the thread around it. In order to accomplish this, we must tear the species of sheath which envelopes the bundle of axillary vessels and nerves. As the artery is situated between and behind the vein and the first nerve which we see in this space in proceeding from the thorax towards the shoulder, we will always seize it without great difficulty, if we take the precaution to enter the aneurismal needle upon the external side of the vein, and push this vessel towards the internal side of the region.

The ligature should not be placed too near the subclavius muscle, on account of the thoracic nerve and cephalic vein which cross the artery at this point; neither should it be applied too near the pectoralis minor, because there we generally find the origin of the acromial and anterior thoracic arteries, etc.

(c) The second portion of the axillary artery is concealed by the pectoralis minor; the nerves, all of which were situated at its external, anterior and posterior sides, send before and behind two cords which cross it very obliquely, in order to reunite upon its internal part, where they form the median. In this manner the axillary plexus constitutes a kind of sheath for the artery, and the vein is no longer in immediate contact with it; and it is besides more approximated to the arm than the chest. Anteriorly and externally it corresponds to the biceps and pectorales; posteriorly, to the subscapularis, and internally, but remotely, to the

serratus major. We should never attempt to apply a ligature upon this portion of the vessel; the relations which have just been pointed out are sufficient to shew us the dangers which would result from such an operation. If we wished to compress it here, the pressure should be directed against the head of the humerus; but this will scarcely be possible except in thin subjects; and if it was absolutely necessary to suspend the circulation in the limb, it would be better to establish the compression behind the clavicle; we might also apply the compressive means anterior to this bone, through the *pectoralis major* muscle, upon the second rib. The latter method, however, is difficult and uncertain.

(*d*) Lastly, the third portion is seen in the *subpectoral triangle*. In passing through this space, the artery has, upon its radial side, one root of the median, and the musculo-cutaneous (*perforans Casserii*); upon its cubital side, are seen the posterior root of the median, the internal cutaneous and the ulnar; externally and posteriorly the radial and the axillary or circumflex. The axillary vein bears the same relations to the artery here as it does to its middle portion, which is covered by the *pectoralis major*. This vessel rests, posteriorly, upon the tendon of the *subscapularis* and *latissimus dorsi*; externally, it is applied against the humerus, where we may compress it pretty readily. The aponeurosis, cellular tissue and integuments ascend so as to cover this artery, internally, in emaciated persons. In this third of its length, the axillary artery may be tied in two different manners; in the first place, by making an incision parallel to its direction, between the two borders of the arm-pit; and in the second, by cutting upon the fore part of the *pectoralis major*, perpendicular to the direction of this muscle, which should be cut across in order to expose this artery. In either case, we must expect to find a sheath of considerable strength, which envelopes, at the same time, the artery, vein and nerves. This sheath being laid open, it is very easy to separate these different organs from one another, and pass a thread around the vessel.

The branches given off from the axillary artery are: the acromial, anterior thoracics, external mammary (*thoracica longior*), the *subscapularis* and *circumflexi*.

(a) The *acromial*. This branch, in some subjects, separates from the trunk pretty near the subclavius muscle, but more frequently immediately above the pectoralis minor; for which reason it is generally preferable to apply the ligature nearer the clavicle. Sometimes this branch gives off the anterior thoracics; in which case it is much larger at its origin. The acromial portion then passes directly before the pectoralis minor, in order to bifurcate behind the cephalic vein, under the apex of the coracoid process; one of the branches of this bifurcation passes upon the dorsal surface of the osseous eminence, and goes to lose itself in the deltoid. This branch, which is sometimes as large as a crow quill, is necessarily divided in the amputation of the arm at the joint, according to the method of MM. Champesnes and Lisfranc.

The other branch runs in the *coraco-deltoid* groove, is at first on the inner side of the cephalic vein, afterwards passes under it, then on its external side, and finally anterior to it: which must be borne in mind, if we should fix upon this place for venesection.

(b) The *anterior thoracics* originate, the superior, in the *clavio-pectoral* triangle, and sometimes even from the acromial; the inferior, from the middle portion of the axillary, under the pectoralis minor muscle; their branches are chiefly distributed to the pectorales muscles, and intersect each other, in divers manners, in the cellular layers which separate them; so that they are frequently much in the way in the ligature of the axillary artery.

(c) The *Mammaria externa* originates opposite to the inferior margin of the pectoralis minor and descends upon the side of the thorax, between the serratus anticus and pectoralis major, to lose itself in the integuments. It is this which we open most frequently when we are seeking for some tumour in the axillary cavity, as scirrhus glands, for example, which are generally situated more anteriorly than posteriorly. It also gives off some other branches externally, which ramify in the latissimus dorsi and teres major.

(d) The *Scapularis Communis*, or Subscapularis, is found on a level with the anterior margin of the subscapularis muscle: it descends behind the nerves before the costa of the scapula, and

soon bifurcates. It is the largest branch given off by the axillary, and for this reason, we should tie the latter artery above or considerably below it.

The *anterior branch of the subscapularis*, smaller than the posterior, continues the primitive direction of the trunk, and rami- fies in the muscles of the posterior border of the region; *the posterior*, or *dorsalis scapulae*, curves over the anterior margin of this bone, in order to pass into the posterior region of the shoulder, where we will see it again, as well as the preceding.

(e) The *Arteriæ Circumflexæ* frequently arise by a single trunk, very near the subscapularis, from which they are sometimes derived. In either case, the *posterior circumflex* artery passes immediately behind the shoulder, through the quadrangular opening which the posterior paries of the axilla presents, under the head of the humerus.

The *anterior*, smaller than the other, is situated behind the musculo-cutaneous nerve, the coraco-brachialis, biceps and deltoid muscles. It is applied upon the bone, and divides at the bicipital groove. With the posterior, it forms an arterial circle around the neck of the humerus, a circle which may be lacerated in fractures of this neck; whence result those extensive ecchymoses which occasionally manifest themselves in consequence of these wounds.

The origin, volume, number, and distribution of all these branches, are susceptible of infinite varieties. The trunk of the axillary also presents many anomalies. We have sometimes seen it divided into two branches, and, in this case, one of the branches is posterior, larger, and gives off the brachial, properly so called; the other is anterior, smaller, and seems to be formed by the radial prolonged as far as the axilla. We have seen this division continued even under the subclavius muscle.

VI. *The Veins.*

The *Axillary Vein*, may be divided like the artery, into three portions: its superior portion is very large and is situated, internally, upon the border of the first rib, the first intercostal muscle, the second rib, and the superior point of the serratus major anticus: externally and posteriorly, upon the axillary artery, to which

it adheres by pretty compact cellular lamellæ; anteriorly, it receives a process from the coraco-clavicular aponeurosis which strengthens its external tunic; it is afterwards crossed by the anterior thoracic nerve and arteries, then it is covered by the celulo-adipose sub-muscular layer, etc. The dilatation of the veins, which takes place during expiration, causes this portion of the axillary vein to conceal the artery entirely. As this dilatation is one of the principal obstacles to placing a ligature around the artery, it would perhaps be advantageous, in performing this operation, to adopt the plan proposed by Mr. Lizars, that is to say, to suspend the venous circulation below the axilla by the compression of the extremity.

Behind the pectoralis minor, the axillary vein is crossed by the branches of the inferior thoracic artery, and it is separated from the internal surface of the artery by the two roots of the median nerve.

In its inferior portion, it is still on the inner side of the artery, but it is situated more anteriorly, and the median, internal cutaneous, and ulnar nerves separate these two vessels. Anteriorly it is crossed by the external mammary artery, the two nervous branches which pass from the second and third intercostals to the hollow of the axilla, and some other filaments; consequently, the whole of the brachial plexus is situated behind and external to it.

It is generally in the *sub-pectoral triangle* that it receives the basilic vein, which sometimes equals it in size, and the collateral veins of the subscapulary, circumflex, and, sometimes, external mammary arteries. The latter and the basilic empty into it upon its internal and anterior part; the others, on the contrary, into its external and posterior portion, and their trunks are seen in the interval of the nerves of the brachial plexus.

Hence it follows that the veins form in this situation a very complicated plexus, which produces much embarrassment when we attempt to isolate the artery.

In some subjects, these different venous branches remain distinct even under the pectoralis minor; but this is rare, for generally the external mammary and inferior thoracic veins open into each other under this muscle. In the superior third the axillary vein receives an uncertain number of small venous twigs; but

uniformly the superior thoracic and the acromial are there emptied into it.

The *cephalic* vein also enters the subclavian, and from its surgical importance it requires minute investigation : it is moreover the only superficial branch which deserves our attention here. It is lodged in the groove which separates the deltoid and pectoralis major, and is more or less deeply situated in proportion to the degree of separation of these two muscles. When the groove is but slight, the vein is very superficial ; but when it extends to the bone, the vein is deeply seated. In the middle of this groove the cephalic vein is enveloped by cellular lamellæ and adipose vesicles. In making its way under the clavicle, it passes along the inner side of the coracoid process, before the origin of the biceps and coraco-brachialis muscles and the insertion of the pectoralis minor ; it crosses the nerves of the brachial plexus and axillary artery obliquely, and falls into the vein upon its external and anterior side, quite near to the subclavius muscle. In this track, this vessel crosses the acromial artery in such a manner that the latter forms a semi-spiral turn upon the vein, as it is passing behind it.

From what has preceded, it follows that the cephalic vein is, all other things being equal, more superficial the nearer it approximates to the deltoidal groove ; that it is always separated from the skin by an adipose layer which varies much in thickness, and that an artery of considerable volume runs by the side of it. Consequently, if we wished to open it in venesection, it would be preferable to do it rather below than high up. We cannot say that a similar operation would be dangerous ; but it appears to us so serious, that it is doubtful whether it should be frequently performed when bleeding presents difficulties at the bend of the elbow.

VII. *The Lymphatics.*

They are very numerous in this region : all the lymphatics of the superior extremity, those of the exterior of the thorax, and a part also of those of the posterior portion of the neck enter into it. We find in it a considerable number of lymphatic glands, some of which form a species of chain around the vessels, whilst the others are distributed into two series. The one constitutes

an anterior plane situated between the anterior paries of the axilla and the vascular and nervous plexus. The other, or posterior plane is placed between the same plexus and the posterior paries of the axilla. These glands occupy, still more especially, the space which separates the vessels and nerves from the serratus magnus, and this circumstance is very advantageous to the surgeon; for, when the extirpation of these organs becomes necessary, by recollecting this anatomical disposition, we would not be so readily stopped by the depth of their situation. There is also a very simple method of ascertaining whether it is prudent to attempt their removal; it consists in raising the arm from the trunk: if, in this position, the tumours remain applied upon the thorax, or, simply, if they do not follow the limb in its movements, it is certain that they have no intimate relation with the vessels and nerves.

We know with what facility these glands become engorged and swollen in diseases of the breast in females, of the whole chest in both sexes, and especially in those of the superior extremity. This sympathetic enlargement frequently leads us to detect an affection in parts where we would scarcely suspect it. It is in virulent inflammations and suppurations particularly that the axillary glands tumefy with great rapidity; it is on such occasions also that the suppuration sometimes invades, with an alarming celerity, the lax and abundant cellular tissue which surrounds them: hence those enormous abscesses which are propagated so speedily into the circumjacent regions, through the medium of the cellular prolongations. When swollen, these glands very frequently produce infiltration of the limb: is this merely owing to the obstruction which the lymph meets with in its course to the organs destined to receive it? Is it an effect of the compression of the bloodvessels, the veins, for example? The first cause appears to us to be the most frequent; the second, however, is not very rare.

It is necessary to remark, that in the cavity of the axilla there is every condition reunited that can favour the production of inflammation within it, and the rapid termination of this inflammation in an abundant purulent secretion: thus, the vascular and thin skin, constantly sliding over the tissues which it covers: a very abundant, supple, and extensible cellular texture, filled

with vessels; nervous filaments in great numbers; an almost constant stretching of these parts, from the natural motions of the limb, &c.

It is also in consequence of these conditions that leeches applied to the arm-pit usually produce in it extensive ecchymoses.

VIII. *The Nerves.*

Almost all of them are derived from the brachial plexus. The greater part of this plexus is found in this region: in the *clavio-pectoral triangle* its cords are collected in a bundle behind and on the outer side of the artery; free under the clavicle and towards the summit of the axilla, where it lies upon the cellular tissue, it corresponds, anteriorly, to the *coraco-deltoidal groove*, and is consequently only separated from the skin by fat, cellular texture, and the transverse branch of the acromial artery, the cephalic vein lying more internally. It does not follow from these relations that this plexus is not very deeply seated; but they admit of its being reached without dividing the muscles. For example: a pointed instrument, thrust perpendicularly to the axis of the trunk, upon the internal border of the coracoid process, in the retiring angle (*angle rentrant*) which exists between the clavicle and this eminence, will fall directly upon the nerves, and will scarcely expose the artery.

It is in passing under the pectoralis minor that this plexus unravels itself: it is then that it detaches two branches which pass below and before the axillary artery and place themselves between this vessel and the vein of the same name, in order to form the median nerve. Below this muscle, that is to say, in the *sub-pectoral* space, all the nerves of the arm are usually isolated.

(*a*) The *Median Nerve* remains on the inner side of the artery, and sometimes is found before it when it enters into the brachial region; so that if we attempted to tie the arterial trunk in this part of the axilla, it would be more easy to draw this nerve backwards, near the pectoralis minor muscle; and, on the contrary, to pull it forwards, if we operated near the anterior border of the region. The vein or veins lie upon its inner side.

(*b*) The *Musculo-Cutaneus*, which is continuous with the anterior root of the median, removes from the vessels and gains

the posterior surface of the coraco-brachialis muscle, which it traverses. Its relations with the artery, therefore, are very remote.

(c) The *Circumflex* separates from the posterior part of the plexus, a little higher than the inferior border of the subscapularis muscle, over which it turns in order to pass under the cervix humeri through the *sub-scapulo-humeral aperture*. The relations of this nerve with the bone are such, that, in fractures of its neck, it may be lacerated and occasion severe symptoms. In luxations downwards, also, it is almost necessarily compressed by the head of the humerus.

(d) The *radial* or *musculo-spiral* is detached on a level with the circumflex, and frequently these two cords form at first only a single trunk. Situated completely behind the plexus, it turns, as it descends, upon the inner surface of the humerus, and enters between the internal and posterior portions of the triceps. It may likewise be stretched, or lacerated, in fractures, and compressed in luxations inwards. It has no immediate relations with the artery.

(e) Internally and anteriorly, we see the *Internal Cutaneous*, which is placed between the vein and artery, and is sometimes so large that some persons have mistaken it for the median, when seeking for the axillary artery.

(f) The *Cubital* (Ulnar) is more internal and posterior: it is also covered by the veins. Its volume is equal to that of the median, from which we distinguish it by its position, and because in removing from its origin it also removes from the artery, inclining backwards.

Such is the arrangement of the six brachial branches of the axillary plexus; but this plexus gives off in the axilla some other nerves, which we are now going to point out: these are the anterior thoracic and subscapular branches.

(g) The *Thoracic Nerves* vary in number, but there are two in particular which we shall mention.

The *first* originates from the fore-part of the plexus, in the summit of the *clavi-pectoral space*, and runs obliquely forwards, downwards, and inwards: it gives several filaments to the celluloadipose layer, and terminates by a small number of ramuscles in the pectoralis major muscle. Near its root, it passes over the

axillary vessels; so that it may interfere with the ligature of the artery, and, in order to avoid it, it should be pushed upwards and towards the sternum. It is, moreover, between this nerve and the acromial artery that the thread should be applied around the axillary artery. Near its origin it is also crossed, in its turn, by the termination of the cephalic vein.

The *second branch* arises a little lower down and runs behind the artery, then between it and the vein, in order to pass under the inferior margin of the pectoralis minor, and is lost in the posterior surface of the pectoralis major. As it passes round the arterial trunk, this nerve is sometimes so adherent to it that it is pretty difficult to separate them. It is of importance to recollect this circumstance when about to tie this vessel.

(*h*) The *Subscapulary nerves* vary still more in number than the thoracics. They all pass backwards in the cellular tissue, and terminate in the muscle which bears their name. They may be compressed, like all the others, in luxations inwards, or by tumours which form in the cavity of the axilla.

(*i*) Posteriorly and internally, we observe the *posterior thoracic nerve*, which comes from the supra-clavicular region. This cord rests upon the axillary aspect of the serratus major anticus, to which it is distributed. It is important to recollect its relations, in order that we may avoid it in operating in the hollow of the axilla; for, if the function of this nerve should be annihilated, it might very seriously disturb the mechanical phenomena of respiration, since it is the only one which is distributed to the serratus magnus. It is for this reason that Mr. C. Bell has called it the inferior external respiratory nerve. Reasoning would lead us to infer that the posterior border of the shoulder would then be more prominent backwards and upwards, and that the scapula would no longer be immediately applied upon the side of the thorax. We have seen a man of twenty-six years of age, strong and of a good constitution, who was in this state for six months. He had fallen and struck the cavity of the axilla against the angle of a bureau. The phenomena which have just been mentioned appeared to us to depend upon a paralysis of the serratus magnus. This young gentleman recovered under the repeated application of blisters around the shoulder and thorax.

(*j*) The *Intercostal Twigs* of the axilla, coming out from the

thorax, are placed upon the second and third ribs, before the corresponding digitations of the serratus magnus, and ramify in the cellular tissue, in the lymphatic glands, around the vena basilica and in the skin. These are the filaments most frequently wounded in extirpating glands which have become scirrhus in consequence of cancer in the breast: it is perhaps these nerves also which occasion the sensation of anguish, constriction, and the distressing suspirations with which patients are afflicted in these affections.

IX. *The Skeleton.*

The *Skeleton of the Sub-Clavicular Region* is composed of the anterior and internal half of the head of the humerus, and of the corresponding surfaces of this bone; of a part of the clavicle, and of the four ribs which follow the first; of the coracoid process and of a part of the acromion, and of the scapulo-humeral articulation.

(a) The *Humerus* here presents the bicipital groove which receives upon its anterior labium the tendon of the pectoralis major, and upon the posterior, those of the latissimus dorsi and teres major. It is important to mark these insertions, both on account of fractures and luxations. For, if the fracture exists lower down, yet above the insertion of the deltoid, the superior fragment will necessarily be drawn near the trunk by the action of these muscles: if, on the contrary, it takes place above them, the superior fragment will be free on this side, whilst the inferior, in its turn, will be drawn towards the chest. In luxations, if the displacement occurs whilst the inferior extremity of the humerus is fixed upon the ground, during a fall, or upon any solid body whatsoever, let the cause be direct or indirect, it is evident that the muscles just mentioned will act upon the os brachii as on a lever of the third order. Hence, as the power in this case is very near the moveable point, we conceive that the head of the humerus will be drawn forcibly inwards.

The bicipital groove becomes deeper and deeper as it ascends, and when it passes between the two tubercles of the head of the humerus, it is converted into a complete canal by the articular capsule; this disposition is perfectly in relation with the usages of the biceps muscle: by this mechanism, it is impossible for the

tendon of this muscle to escape from the sinus in which it is lodged, during the rotatory movements of the arm, and its contractions are in no measure impeded, let the position of the limb be what it may.

Anterior to this groove, the aspect of the humerus is rounded; the deltoid muscle covers, but does not adhere to it; it is separated from it by a lamellated cellular tissue; two thirds of the greater tuberosity (*trochiter*) are placed under it, into which the tendons of the supra and infra-spinati muscles are inserted.

Posteriorly, we observe the insertion of the coraco-brachialis muscle, which, in fractures of the neck of the bone, will act upon the lower fragment in the same direction as the pectoralis major muscle, etc., likewise tending to draw it forwards and upwards: the lesser tuberosity of the os brachii (*trochin*), upon which the tendon of the sub-scapularis muscle is fixed, represents tolerably well the powerful extremity of a lever of the first order. Below these tuberosities, between them and the body of the bone, is the *surgical neck*. This neck is smooth and round, and does not present any muscular impression; which renders it more susceptible of fractures. These fractures are accompanied with peculiar dangers, and present special indications: 1st. dangers,—because the circle which is here formed by the circumflex vessels may be lacerated, and it is doubtless to the laceration of the vein in particular, that we must attribute those extensive ecchymoses which sometimes follow fractures of this nature;—because the nerve of the same name may also be stretched, or lacerated; which might paralyze the deltoid, in the first place, and afterwards give rise to very severe nervous symptoms; and finally, because the inferior fragment, almost always drawn inwards and upwards, may compress, stretch or tear the nerves and vessels of the axilla. 2d.—The indications which present themselves arise, first, in consequence of these accidents, afterwards because the apparatus can scarcely act but on the inferior fragment of the bone; for which reason the ordinary bandages for fractures of the humerus, in general, those of Ledran and Desault for its neck, and many others, are almost useless, whilst it is sufficient, in order to accomplish the proposed object, to place a pad of moderate thickness between the arm and chest, and keep the limb approximated to the trunk in any manner what-

soever; indeed, we might do without the pad. We have seen this very simple means uniformly successfully employed by M. Richerand at the Hospital Saint-Louis; and it may be readily explained: in fact, all the muscles which produce the displacement of the inferior fragment are relaxed by this position of the arm; this same fragment is then pretty forcibly drawn outwards by the tense fibres of the deltoid, which, on the other hand, prevent the superior fragment from being carried outwards or forwards. Thus, the muscular action which had displaced the parts is the means which we employ to retain them in coaptation, and immobility alone is the necessary requisite for the cure.

We will resume the consideration of the articulation in the region which follows.

(*b*) The *coracoid process* is separated from the acromion by a triangular space (*coraco-acromial*), which the point of the knife traverses in the extirpation of the arm by the process of MM. Champesnes and Lisfranc, and at which it comes out when we follow the method peculiar to M. Lisfranc. We will recur to this again.

Being crossed by the clavicle, it opposes acromio-clavicular luxations. It is on the inner side of this process that the clavicle appears to be deepest. The beak of the coracoid process affords attachment to the pectoralis minor, biceps and coraco-brachialis; whence it follows that its fracture must interfere with the inspiratory movements of the thorax, those of elevation and adduction of the arm, and the depression of the shoulder.

The coracoid process is one of the parts which most directly oppose the luxation of the arm upwards. It is separated from the head of the humerus by a space of about an inch; which space is filled by the *coraco-humeral ligament* and the tendon of the supraspinatus muscle.

We will examine the acromion and the corresponding extremity of the clavicle more particularly in the posterior region of the shoulder.

(*c*) The *Clavicle*, the horizontal branch of the angular lever which forms the skeleton of the shoulder, enters almost entirely into the region of the axilla.

As this bone is one of those which first make their appearance in the fœtus, and as its developement is generally very rapid, some persons have thence concluded that it enjoyed a much greater de-

gree of vitality, and have therefore attributed to this cause its more frequent liability to exostosis and other tumours. To this opinion we might make a great many objections.

Its superior aspect is covered only by the skin, the superficial cellular layer and some fibres of the platysma; so that it may be distinctly felt by passing the finger over the surface, and it is for this reason that we should choose this part of the bone when we wish to discover its fractures.

Anteriorly, the clavicle gives attachment to the pectoralis major at its internal half, and to the deltoid in its external third. In thin individuals the anterior part of this bone may be easily perceived through the skin, because the muscles are inserted nearer to its inferior than its superior aspect; but in fat persons, the cellular tissue raises the integuments so much, that we cannot always distinguish the displaced fragments by means of the touch, unless the fracture exists in that portion which is convex forwards.

Posteriorly, the attachment of the trapezius corresponds to that of the deltoid: opposite to the pectoralis major muscle, the bone is free, and its diseases, in this direction, may be easily appreciated. In general, the clavicle may be fractured in any part of its length; but it is more frequently broken at the place where the attachments of the deltoid and trapezius terminate, than elsewhere; and for these reasons, because, on the one hand, the bone there affords less resistance, and, on the other, because it is at this point that the two curvatures meet; whence it follows that, in a fall upon the shoulder, for example, the weight of the body and the resistance of the ground, tend to cross one another at this point of conjunction of these two osseous portions. This last reason also explains why these fractures are almost always oblique, and why the slope of the internal fragment most frequently takes place at the expense of the posterior aspect.

When the clavicle is fractured by a direct cause, the solution of continuity generally exists at the union of its two internal thirds, on account of the greater convexity of the bone at this point, which renders it more exposed to the action of external violence.

In this last case the displacement must take place in the following manner: the internal fragment is drawn upwards by the

sterno-mastoid muscle, to which the pectoralis major opposes but a very feeble resistance; the external, on the contrary, being supported by the trapezius only, is drawn downwards and forwards, by the subclavius, the deltoid and the great pectoral.

If the fracture is situated in the point first indicated, or more externally, it is possible that there will be only a slight degree of displacement transversely, because the trapezius and deltoid externally, the pectoralis major, subclavius and sterno-mastoid internally, mutually counterbalance the action of one another. As to the displacement longitudinally, it manifests itself whatever may be the point of fracture. The muscular portion, which brings the arm in adduction, at the same time that it raises it, having no longer a fixed point, and the prop which is placed between the shoulder and sternum, no longer existing, it follows that these patients will be unable to carry the hand to the face without depressing the head. This phenomenon, although pretty constant, is not universally so, and we have seen, this year, in the hospital of the *Ecole de Medecine*, a man of forty, who had been afflicted with a very oblique fracture of the clavicle, with considerable overlapping, for three days, move and make use of his arm, which he raised to the vertex with the greatest freedom. M. Breschet, surgeon of Hotel Dieu, has recently met with a similar example. Do not these cases give support to the opinion of those who admit that fractures of the clavicle do not actually require any other apparatus than the simple supporting bandage (*bandage contentif*)? It is necessary to observe, however, that by acting thus we do not prevent the overlapping of the bones, and the contraction which may thereby take place in the axillary space may, perhaps, be carried so far as to permit the compression of the vessels and nerves.

(d) The *Ribs* do not present any thing very remarkable in the sub-clavicular region; the second only, on account of the slight inclination of its external surface, and its more superficial position, deserves some attention. It is upon this rib that John Bell advises compressing the axillary artery, rather than behind the clavicle. We have already said that this precept ought not to be followed. The other ribs, in this region, can but rarely be fractured, on account of the thickness and solidity of the parts which cover them. This must be understood, however, to refer to direct

fractures only ; for those which originate from pressure on the sternum, etc., may take place in these ribs as well as in the others. These accidents will even be more dangerous here than elsewhere, on account of the organs contained in the axilla.

The following is the order of *super-position* of the parts in the region which we have just examined : In the first place we meet with, from before backwards, 1st. the skin ; 2d. the superficial layer, including some fibres of the platysma, small veins and fat ; 3d. the thin prolongation of the aponeurosis, or the cellular lamina which covers the muscles ; 4th. the pectoralis major and minor, the deltoid, an inter-muscular cellulo-adipose layer ; 5th. the biceps, coraco-brachialis and subclavius ; the coraco-clavicular aponeurosis, much cellular tissue and lymphatic glands ; 6th. the nerves and vessels ; 7th. cellular texture also, then the subscapularis muscle externally, and the serratus magnus internally.

Next, from the base to the apex [of the region] we find, 1st. the skin, covered with hairs ; 2d. the subcutaneous layer ; 3d. the aponeurosis ; 4th cellular tissue in great abundance, lymphatic glands, venous and arterial ramuscles ; 5th. the axillary artery and vein, then the brachial plexus ; 6th. cellular lamellæ filling the sub-clavicular aperture.

Sect. 2. Posterior Region of the Shoulder, or Scapular Region, properly so called.

This region is naturally bounded, posteriorly, by the spinal border of the scapula ; anteriorly, by the *acromio-digital line* ; superiorly, by the supra-clavicular region ; and inferiorly, by the posterior margin of the axilla.

It represents a triangle with its truncated summit directed forwards.

Its surface presents several prominences and depressions, which may easily be distinguished through the skin : thus, posteriorly, we may distinctly feel, through the trapezius muscle, the posterior margin of the scapula, likewise the superior and inferior angles of this bone ; inferiorly, the thick and rounded border of the latissimus dorsi ; from above downwards and from before backwards, the coracoid process, and a ridge running from the posterior border of the middle region of the shoulder, which corresponds to the

spine of the scapula, to the acromion or clavicle : still lower, we discover another eminence produced by the infra-spinatus muscle. The deltoid and the head of the os humeri generally form a very distinct prominence likewise. Between the two latter eminences, we observe a kind of groove which runs from the acromion into the cavity of the axilla and which we will call the *posterior deltoïdal groove* ; finally, there is still another species of hollow between the acromion and the clavicle.

CONSTITUENT PARTS.

I. *The Skin.*

The skin is thick in the superior, but still more so in the posterior part of the region ; less so anteriorly and especially inferiorly : it is never covered with hairs, and we see no wrinkles in it, except those which result from the arrangement of the papillæ. Its sebaceous follicles are not very numerous, but are very large ; its vessels form a complicated plexus, and its sensibility is sufficiently acute. It is on account of these characters, as well as the compact texture and slight extensibility of the skin, that the boils which are so frequently developed within it generally produce a great deal of pain, and appear to differ but little from simple anthrax.

II. *The Subcutaneous Layer.*

This layer contains a considerable quantity of arterial and venous ramuscles, but few nerves ; its adipose cells are few in number, at least opposite to the osseous eminences : its cellular tissue is both lamellated and filamentous ; it is supple and so disposed as to admit of a pretty extensive mobility of the skin over the supra and infra-spinal fossæ ; over the deltoid, in certain subjects, it contains considerable fat ; is dense and apparently fibrous over the spine of the scapula, the acromion and clavicle, where it sometimes forms a complete mucous or synovial bursa, which facilitates the movements of the shoulder : in fine, it is pretty intimately united to the skin, but is very readily separable from the aponeurosis. In consequence of this disposition, wounds

in the posterior region of the shoulder, which do not extend to the muscles, should and may be united by the first intention by means of plaisters, bandages or sutures; but we must take care that pus or other fluids do not accumulate between the aponeurosis and the wound.

III. *The Aponeurosis.*

It is formed by a considerable number of sheets, which are at first distinct by their position and usages, but afterwards become blended with those of the surrounding regions. Thus, one sheet, the two laminæ of which are continuous, before and behind the trapezius, with those of the back and neck, descends from this muscle towards the superior margin of the latissimus dorsi, where it splits in order to envelope the latter muscle, and afterwards becomes continuous with the brachial aponeurosis. This sheet is generally thin upon the muscles, where it merely represents, if I may so say, a simple cellular layer. In the interval which separates them, below the spine, it is thicker and evidently fibrous. Although dense, it nevertheless always preserves a certain degree of extensibility, which prevents its being confounded with the other laminæ of this region.

Of these laminæ, there is one which originates from the inferior margin of the spine and the posterior border of the scapula, and passes towards the side of this bone, dividing in such a manner as to form two intersections between the teres major, teres minor and infra-spinatus muscles; after which it becomes continuous with the preceding sheet under the axilla. On the other side, it also splits on a level with the posterior deltoidal border, so that one of its lamellæ, which is the thinnest, applies itself upon the deltoid muscle, becomes blended with the superficial sheet which has just been examined, and is lost in the aponeurosis of the superior extremity; the other remains under the deltoid, forms a pretty compact sheath for the infra-spinatus muscle, which it follows to the head of the humerus, where it is confounded with the articular capsule. We might call this the *infra-spinal aponeurosis*.

Finally, we find a third lamina above the spine of the scapula: this binds down the supra-spinatus muscle, and is confounded, anteriorly, with the coraco-clavicular and acromio-clavicular liga-

ments, behind the clavicle and the capsule of the joint. We can conceive how important it is to be well acquainted with the arrangement of these aponeuroses, when we wish to ascertain the seat and danger of abscesses or other affections at the posterior part of the shoulder.

IV. *The Muscles.*

In order to have an exact idea of these organs in the scapular region, it is necessary to divide it into four portions; which are: 1st, the *Supra-Spinal*; 2d, the *Infra-Spinal*; 3d, the *Axillary*; 4th, the *Humeral*.

(a) In the first (*supra-spinal*), we find the *trapezius*, which is inserted into the superior border of the spine of the scapula, from its tubercle as far as the clavicle. The fibres of this muscle, in this point, being oblique upwards and backwards, it follows that when they contract they must raise the shoulder. It is separated from the supra-spinal aponeurosis by a cellular layer, sometimes of moderate thickness, which establishes a communication with the supra-clavicular and axillary regions.

Next the *Angularis*, which is in fact only a digitation of the *serratus major anticus**, and which appertains to the regions of the neck. With respect to the shoulder, we see that it tends to draw up the posterior angle of the scapula, and that if this bone was fractured transversely, it would separate the fragments considerably.

After the *angularis*, is the *omo-hyoideus*, another muscle of the supra-clavicular region. As this fasciculus is attached to the superior costa of the bone, behind the coracoid notch, its action upon the shoulder must be very slight; on the contrary, it derives from this bone its fixed point, in order to depress the larynx. As it ascends, it leaves between it and the coracoid process a small triangular space, through which the supra-scapular nerve and vessels occasionally pass, previous to their entrance into the supra-spinal fossa.

Finally, the *Supra-spinatus Muscle*, which fills, and is firmly fixed in the fossa of the same name, by the aponeurosis. It

* M. Dumeril.

should be observed that in passing under the acromio-clavicular arch, it is applied directly upon the articulation, as well as upon the head of the humerus, previous to its insertion into the trochiter, and that it there slides in a supple fibro-cellular tissue, which communicates with the axilla by the posterior surface of the deltoid.

(*b*) In the *Infra-spinal portion* we find, posteriorly, near the spine, a small portion of the *trapezius*. Here, this muscle is converted into a strong aponeurosis, which fixes it to the tubercle of the osseous crista. There is generally a bursa mucosa under this aponeurotic triangle.

Posteriorly also, but still more inferiorly, we find a small portion of the *latissimus dorsi*. Sometimes this muscular bundle is attached to the angle of the scapula, at other times it only slides over this bone as it is passing into the axillary portion of the region. In either case this muscle, as well as the trapezius, principally acts here by pressing the scapula against the thorax.

Anteriorly, we observe the scapular portion of the *deltoid*, the border of which becomes more and more isolated in proportion as it approximates the humerus. Between this border, the trapezius and latissimus dorsi, there is a triangular space, of a certain extent, in which the skin is only separated from the infra-spinatus muscle by the aponeuroses. Under this space and the preceding muscles, we meet with the *infra-spinatus*.

This muscle originates from and fills the fossa infra-spinata, but is less and less adherent to it in proportion as it proceeds forwards; covered by the deltoid, it passes under the acromion; its tendon approximates the supra-spinatus, crosses the articulation in the same manner, and gliding under the acromial arch is inserted into the trochiter. It is equally enveloped by the cellular tissue which forms a communication between its fossa and the cavity of the axilla. It is important to notice that as the supra and infra-spinata muscles are enclosed in a species of sac, which is fibrous behind and osseous before, abscesses which form in their substance, or in their sheath, cannot, without difficulty, make their way out in any other direction than by that which leads to the axilla.

(*c*) The *Axillary portion* includes the *latissimus dorsi*, the *teres major*, and *teres minor*; but only the fleshy portion of these mus-

cles. The two former are separated by a sheet of the superficial aponeurosis, but soon become confounded with each other: as they remove from the third, they slide upon the humerus anterior to the triceps, which separates their tendon from the deltoid. As the teres major acts upon the inferior angle of the scapula, when the arm is fixed, as upon a lever of the first order, it thence follows that, in order to consolidate fractures of the os humeri, the arm must be retained close to the trunk. The teres minor, which appears to be only a fascis detached from the infra-spinatus, ascends parallel to the latter under the deltoid, in order to fix itself to the great tubercle (*trochiter*) of the os brachii; so that, when it acts upon this bone, it may be considered as the antagonist of the sub-scapularis. The space which separates it from the teres major is filled with cellular tissue, and encloses the posterior branches of the sub-scapular vessels. As it is on the outer side of the joint, its anterior surface rests upon the long portion of the triceps.

(*d*) In the *humeral portion* we observe the middle bundle of the *deltoid*, the curved fibres of which, in raising the arm when it is free, act upon the os humeri as upon a lever of the third order. But, when the moveable extremity of the limb is retained by some power, this muscle might depress the head of this bone, and thus favour the luxation downwards. This fascis is, as it were, moulded upon the articulation, from which, however, when the arm is pendent by the side of the thorax, it is separated by a space of almost an inch. A broad kind of bursa mucosa exists in this space, which in general contains but a small quantity of fluid.

(*e*) Upon the *humerus*, properly so called, we find the extremity of the three portions of the triceps, of which the external (*great head*) is nearest to the deltoid, and is occasionally continued by its extremity as far as the tendon of the teres minor. The middle portion (*long head*) gradually detaches itself from the humerus, and passes upon the inferior costa of the scapula, to which it is attached about half an inch below the glenoid cavity. It then becomes flattened, and its posterior surface is concealed by the teres minor, and lower down by the brachial aponeurosis. Anteriorly, this muscle rests upon the broad tendons of the latissimus dorsi and teres major, beyond which it is free in

the hollow of the axilla; and, close to its attachment, it rests partially upon the subscapularis muscle. When the arm is fixed, this muscular bundle acts upon the scapula in the same manner as the *teres major*; with this difference, however, that here this action inclines, in great part, to the profit of the solidity, because the branch of the lever is considerably shortened. Relative to the articulation, when the arm is raised, the *triceps* represents a tense cord, which opposes luxation downwards by supporting the head of the humerus; but in fractures of the neck of this bone, it tends to displace the fragments in a longitudinal direction.

As the tendons of the *latissimus dorsi* and *teres major* are inserted into the posterior labium of the bicipital groove, they must turn the arm outwards; and, as their inferior margin is continuous with the brachial aponeurosis, this fibrous sheet is very apparent when these muscles contract. We will soon re-examine the *supra* and *infra-spinatus* muscles and *teres minor*.

v. *The Arteries.*

(a) They are derived from the *supra-scapulary*, the *transverse cervical*, the *subscapulary* and *circumflex* arteries.

The first (*Supra-scapulary*) plunges into the fossa *supra-spinata*, often above and sometimes below the ligament which converts the *coracoid notch* into a foramen. The branches which it here gives off, and which are here distributed to the *trapezius*, *supra-spinatus*, *angularis*, etc., muscles, are generally so small that they do not require a ligature when we perform operations upon these parts. One of its branches remains in the fossa *supra-spinata*; the other goes under the spine of the scapula, passing under the *acromion*, behind the *glenoid cavity*, and is lost in the *infra-spinatus*, *teres minor* and *major* muscles. This artery is important in surgery only in relation to its numerous *anastomoses*.

(b) The *Transverse Cervical* arises from the same trunk with the *supra-scapulary*, and gives to the region of the shoulder its descending branch only; it sends off twigs which pass between the *rhomboideus* and *trapezius*, or which perforate the first of these muscles and *anastomose* with the *ramuscles* of the preceding in the fossa *infra-spinata*.

(c) The third (*subscapularis*) comes from the axilla, and passes through the opening which is circumscribed by the teres major and subscapularis muscles on the one part, and the long portion of the triceps on the other: it ascends between the teres minor and the anterior costa of the scapula, an inch and a half below the glenoid cavity; the largest of its branches dips immediately into the subscapular fossa; the others pass into the deltoid towards the acromion; finally, a considerable number enter the latissimus dorsi, the teres major, etc. As it comes out of the axilla, this artery is sometimes of considerable size; so that a wound penetrating into the *scapulo-humeral* or *posterior-deltoid groove*, might give rise to a troublesome hæmorrhage. In such a case, or for any other reason, it might be exposed, by making an incision parallel to the anterior costa of the scapula, but upon the external face of the deltoid. Then, by dividing the posterior border of this muscle, opposite to the point of intersection of the teres minor and the long portion of the triceps, we will easily find this vessel by holding the arm very much upwards and backwards: so that, in order to reach it, we will have to cut, 1st. the skin; 2d. the adipose layer; 3d. the aponeurosis; 4th. the fibres of the deltoid; 5th. the cellular tissue. The teres minor must be pushed backwards.

(d) The *Posterior Circumflex*, as we have already stated, turns round the bone, and is only separated from that which we have just considered by the scapular portion of the triceps muscle. It is distributed almost entirely to the deltoid, and anastomoses very freely with the anterior circumflex, the acromial, the supra-scapular and the preceding branch.

These are the arterial communications by which the circulation in the arm is supported, when we tie the sub-clavian or axillary arteries. Thus, the acromial with the subscapular and circumflex, on the one hand, and, on the other, with the supra-scapular; the subscapular with the transverse cervical and the external mammary; the latter with the internal mammary and the anterior thoracics, etc., are quite sufficient to carry the blood from the point above the ligature of the principal artery to the parts below, without taking into consideration other branches which it is needless to mention.

VI. *The Veins.*

All the veins of this region follow the direction of the arteries, to which, in general, they are somewhat intimately adherent: but they are much larger; their capillary system in particular is very abundant; hence the frequency of *nævi materni*, spongy (*erectile*) tumours, and *fungus hæmatodes* in the region of the shoulder.

VII. *The Lymphatics.*

These organs present nothing peculiar in this region. Like those of other parts, they consist of two series; one of which is superficial, passing almost entirely to the axillary glands; the other, deep seated, accompanying the veins, and entering into the supra-clavicular and axillary regions.

VIII. *The Nerves.*

They are very numerous, but of moderate size, and consist of the terminations of the spinal accessory, supra-scapulary, and the circumflex which is the principal nerve of this region.

(*a*) The *Spinal* ramifies in the trapezius, and does not appear to send filaments to the skin; so that it is probably destined only for the contractions of this muscle. Consequently, if it was divided, such division would produce paralysis of the movements of elevation and abduction of the stump of the shoulder.

(*b*) The *Supra-Scapulary* comes from the supra-clavicular region: it passes into the coracoid notch, gives filaments to the supra-spinatus muscle, then descends into the fossa infra-spinata, where it divides like the artery of the same. It anastomoses with the scapulary and supra-acromial filaments. As it is situated behind the glenoid cavity, it runs no risk of being injured from amputations, or luxations; but if the neck of the scapula was fractured, it might give rise to unpleasant symptoms.

(*c*) The *Supra-Acromial Nerves* are derived from the cervical plexus, and appear to be distributed to the skin. The brachial plexus gives off the *sub-scapularies*, which pass into the ax-

illary muscles of the posterior region of the shoulder. They are scarcely susceptible of surgical applications.

(*d*) The *Circumflex* is much more important; its volume is sometimes equal to that of the radial. As it comes out of the axilla it passes under the neck of the humerus by the *sub-scapulo-humeral aperture*; it is included in the same cellular sheath with the artery and veins, remains in contact with the bone for a long time, and is lost in the deltoid, of which it is the *nervus proprius*, and in the circumference of the articulation. From this disposition, we may easily comprehend how it is that pressure of this nerve suspends almost all the motions of the arm, and that the head of the humerus, when luxated, may produce this phænomenon. We also conceive that in fractures of the neck very high up, the circumflex nerve is still more exposed to laceration, stretching and even compression, than in the articular displacements.

IX. *The Skeleton.*

It is composed of the whole of the scapula, of the acromioclavicular and scapulo-humeral articulations.

In the scapula and the other osseous parts we should note,

1st. The *Fossa Supra-Spinata*, the inner wall of which is so thin that a pointed instrument may perforate it without difficulty, and thereby wound important organs in the axilla.

2d. The *Fossa Infra-Spinata*, which is not much thicker; but here the same wound would produce accidents of a different nature. For, as the brachial plexus is more anterior, it would probably not be touched, and the vulnerant body would be more liable to penetrate into the cavity of the thorax. This portion of bone may be fractured; but as the aponeurosis adheres to its whole circumference and the infra-spinatus muscle is attached to its surface, they must prevent all manner of displacement, and reduce the method of treatment to retentive bandages simply;

3d. Its *Spine*. The triangular surface which forms the root of the posterior border of this process permits the trapezius to slide upon it, when its inferior fibres contract, as over a pulley. It is so disposed that the deltoid, which elevates the arm, and the trapezius, which draws up the shoulder, derive from it at the same

tune their fixed or moveable point; from which circumstance these two muscles are almost always obliged to combine their actions. As this osseous crest can always be felt through the skin, it follows that when the shoulder of the fœtus presents during labour it may be mistaken for the clavicle, and thereby lead to an incorrect manœuvre in the attempt to turn the child.

4th. The *Acromion*, which is only the continuation of the preceding spine, is inclined slightly outwards and projects at least eight lines before the glenoid cavity; so that a luxation of the humerus cannot take place in this direction without a fracture of this process. In powerful muscular subjects, especially those who exercise their arms very much, the acromion is thicker, stronger, and curved more downwards; so that its beak is sometimes closely approximated to the head of the humerus: such a disposition might increase the difficulty of amputating the arm at the shoulder joint, according to Lisfranc's method. The apex of the acromion, as well as the external extremity of the clavicle, remain cartilaginous until about the age of fifteen years;* in which case, if the acromio-clavicular vault was diseased in such a manner as to require its removal, the cutting instrument would easily divide these parts and render the saw unnecessary. The same would apply to the extirpation of the arm. But we do not see that it would be necessary to remove these parts in the latter operation; on the contrary, they should be left unmolested, on account of the muscles which are attached to them, and which are subservient to the formation of the flap. We have several times observed the acromion process united to the spine of the scapula, in subjects of thirty years, merely by a thin vinculum of cartilage. In a like case we consider that a fracture, or rather a disjunction of the epiphysis, might easily take place. The anatomical disposition of this process is such that, when fractured, the anterior fragment may be forcibly drawn downwards by the action of the deltoid muscle and the weight of the limb: hence the rule for keeping the arm firmly elevated in fractures of the acromion.

5th. The *Coracoid process*, which completes internally the canal through which the tendon of the supra-spinatus muscle passes:

* M. Lisfranc. Archives, Mai 1824.

it is its dorsal aspect which serves as the point of support to the clavicle when its sternal extremity is depressed. The conoid and trapezoid ligaments, which limit the elevation of the latter bone, here deserve some attention. In fact, they are very short, very thick, and consequently very strong: their arrangement, also, is such that the clavicle cannot be carried more than a few lines, either forwards or backwards, without putting them very much on the stretch, and thereby opposing these motions.

6th. The *Clavicle*. This bone is flat and spongy between the two preceding processes, and is about an inch and a half, or at most, two inches in length. Fractures occurring in this portion of the bone cannot be attended with displacement in a longitudinal direction, because the acromion on the one hand, and the coracoid process on the other, invincibly restrain the fragments from crossing each other. Between the spine of the scapula, the base of the coracoid process and the clavicle, we observe a retiring angle (*angle rentrant*) which is filled by the trapezius muscle. Before the clavicle, we observe the small *coraco-acromial triangle*, closed by the ligament of the same name, at which we introduce the point of the knife into the articulation. Finally, notwithstanding this articulation of the clavicle consists in the mere application of simple surfaces, yet the superior and inferior ligaments, and all the parts which unite the clavicle to the acromion, are so compact that its dislocations are difficult and unfrequent. It must be admitted, however, that the infrequency of these displacements are also to be attributed to other anatomical peculiarities: thus, for example, in consequence of the great mobility of the scapula, the two bones of the shoulder always move together; the sternal extremity of the clavicle being fixed, the powers act but with difficulty upon it, after the manner of a lever of the first species, in order to produce this luxation upwards; and the coracoid process opposes the dislocation of the bone, which surmounts it, downwards. We must not, however, with some moderns, deny the possibility of the latter accident, admitted perhaps too lightly by J. L. Petit.

7th. The *Scapulo-humeral articulation*, which comprises the head of the humerus, the glenoid cavity, and the fibrous parts.

The head of the os brachii represents a half sphere, which is proportionately larger in children than in adults; its axis is di-

rected obliquely forwards, outwards, and downwards, so that at its junction with the humerus it forms an elbow which makes it appear longer inferiorly, internally, and posteriorly. At the point of this union there is a groove which increases in depth in proportion as it advances in the direction last indicated. This circular groove, which is the true anatomical neck of the bone, deserves the greatest attention whenever we wish to disarticulate the arm, and more especially when we follow the process of Bécarrd. It is upon this groove, in fact, that the knife must be perpendicularly carried, if we wish to divide the capsule and the tendons effectually; otherwise these parts will become folded, or roll under the instrument, and the section be executed with difficulty. It is necessary then to recollect the axis of this groove exactly, and the plane of the circle which it forms. There are some individuals in whom the head of the humerus continues for a long time in the state of epiphysis; it may then be detached, and this, without doubt, is what has usually been denominated a fracture of this part. We conceive that the consolidation of such fractures is scarcely possible, except in young subjects, and when it advances a little upon the body of the bone; for as the fragment included within the capsule has no *ligamentum proprium*, and is not covered by the periosteum, it will be completely separated from the living organs. The dimensions of the head of the *os humeri* are much greater than those of the glenoid cavity; so that, were it not for the muscles which surround the joint, the weight of the limb alone would be sufficient to produce its luxation. This is not founded upon reasoning alone, for it has actually been ascertained that these dislocations sometimes take place spontaneously in paralytic individuals. In these cases, the muscles of the shoulder having lost their tonic power, as well as their voluntary contractility, cease to support the humerus, which is then supported merely by its capsule. Therefore, as the latter permits the surfaces to be separated as much as an inch asunder, it follows that the least effort may draw the head of the bone in this or that direction.

With respect to luxations of the shoulder generally, we will now readily comprehend the manner and direction in which they may take place.

Taking the axis of the head of the humerus for the point of

departure, we see that, in carrying the arm inwards, the thorax will check its adduction before this axis has escaped from the glenoid cavity; besides, the capsule, strengthened externally by the tendons of the infra-spinatus and teres minor muscles, will oppose a resistance in this direction almost insurmountable.

If we carry the arm backwards, the movement of this axis will soon be stopt by insuperable powers; thus, the supra-spinatus and deltoid will hinder it from rolling too far forwards; and if it tends to slip directly upwards, the capsule, strengthened by the coraco-humeral ligament and the arch which is formed above by the coracoid process, acromion and clavicle, will not permit it to pass beyond the glenoid cavity.

If, on the contrary, it is inwards that the head of the humerus rotates, several circumstances will favour its escape in this direction. First, nothing bounds the movement of abduction outwards and backwards; next, if the arm is elevated, the deltoid may favour this movement in a very evident manner, and lastly the fibrous membrane of the joint is much thinner at its internal part, than outwards and upwards; sometimes, it is even found reduced to a synovial lamina and supported merely by the tendon of the subscapularis; This tendon, it is true, is very strong, and, as the head of the bone tends to remove from it by curving it, it repels or depresses it towards the cavity from which it is disposed to escape, with so much the greater force in proportion as it draws near the moment of abandoning the glenoid cavity. But it is below in particular that luxations take place with most facility.

Let us suppose, for instance, that the arm is elevated to a right angle with the trunk, the elbow being fixed: in this position, the axis of the head of the humerus is very near the inferior margin of the glenoid cavity. Then the deltoid, pectoralis major, latissimus dorsi and teres major will become auxiliaries to the displacing powers, and the only resistance which the latter will meet with will be in the lower portion of the capsule. Now this capsule is also very thin here, and is besides but feebly supported by the tendinous portion of the long head of the triceps. The dislocation directly downwards then, is very easily produced; but as, in this case, the head of the humerus rests only upon the side of the scapula, and as the limb is elongated, the triceps and subscapularis muscles being put upon the stretch will almost always

draw it inwards, and place it between the latter muscle and the scapula. It is possible, however, for it to slip outwards likewise into the fossa infra-spinata; but the capsular ligament is stronger in this direction; the muscles oppose it more directly; the costa of the scapula is inclined outwards, and besides it is rare that the free extremity of the limb is placed in a suitable direction for favouring this displacement.

We may further remark, with respect to the head of the humerus, that the tendons which are inserted into its tuberosities, are so disposed, that, in fractures of its neck, they mutually neutralize each other's action, so that they displace the superior fragment but slightly. Thus, the sub-scapularis, teres minor, and infra-spinatus counteract one another, and together annul what might be effected by the supra-spinatus.

The glenoid cavity is very superficial in comparison with the volume of the semi-sphere which rotates upon it; which disposition is necessary, however, for the extensive and varied movements of the superior extremity. The perpendicular diameter of this cavity is much greater than its horizontal, a circumstance to be kept in mind when we disarticulate the arm. It must also be remembered, on this occasion, that the coraco-acromial arch is nearly an inch above it; whence it follows that between the summit of the acromion and the lower part of the glenoid cavity there exists a space of about two inches and a half, whilst, transversely, this space is scarcely an inch.

Therefore, in order to amputate the arm at the joint, two general methods have been recommended. In the one, the flaps are always parallel to the small diameter of the space indicated above; in the other, on the contrary, they are perpendicular to it.

Should we perform the first, in making an inferior flap only, as practised by Ledran, or a superior, according to La Faye; or should we form two, in imitation of Garengot or M. Dupuytren, we see that the enormous distance which separates the base of these two flaps will always render it very difficult to produce an immediate re-union, and will very frequently dispose to the formation of abscesses.

The conjoined method of MM. de Champesmes and Lisfranc, may secure the patient from some one of these inconveniences; for, if the knife is introduced at the *coraco-acromial triangle*, in

order to traverse the articulation, it is possible to make its point come out sufficiently low, under the external margin of the acromion, to produce a flap more lateral than superior; but then this process will enter into the second method.

It is to the latter that the methods of Sharpe and Bromfield appertain, and especially that of Desault. Whether we make an internal flap, by carrying the knife on the inner side of the humerus, from the apex of the acromion behind the anterior border of the axilla, as directed by Desault, in order to pass afterwards through the articulation and form, in finishing the incision, an external flap; or, on the contrary, we commence, according to MM. Larrey, Roux, etc., with the external flap and terminate with the internal; or, as recommended by M. Dupuytren, instead of forming this first flap by cutting from within outwards, we make a semilunar incision from the integuments towards the posterior part of the capsule; or, finally, whether we cut the flap by carrying the point of the knife before the posterior margin of the axilla, in order to make it traverse the articulation by pushing it upwards and forwards, so that it may come out at the coraco-acromial triangle, as is now performed by M. Lisfranc, it is evident that we will always have two flaps of equal or unequal lengths, which might be approximated, and thus almost entirely obliterate the acromio-glenoidal space. The same would occur from the circular amputation, which is preferred by many English surgeons; as well as by the process of Bécларd, which consists of two incisions, one anterior, the other posterior, which commence at the summit of the acromion, are prolonged obliquely downwards and forwards, and terminate without meeting, in order to avoid the nerves and especially the artery, upon the two axillary borders. With respect to the execution of these different methods, the anatomical arrangement of the parts exacts for each of them particular precautions.

In that of Desault, for instance, the artery should be previously compressed, since it is comprised in the first flap. For the purpose of forming this first flap, it is necessary that the knife should slide beneath the humeral head, for this eminence would otherwise throw it too much inwards; afterwards the arm must be drawn in abduction, in order to penetrate easily into the articulation.

In the two methods adopted by M. Larrey, and in one of those

recommended by M. Dupuytren, as we commence with the external flap, the artery will only be divided in finishing the operation.

In Bécлар's method, the muscles being divided down to the bone, it is necessary to draw upon the humerus so as to render its head prominent, and to turn it in extreme pronation or supination, according to the side. This rotation is, indeed, indispensable, for without it we cannot divide the capsule to a sufficient extent upon the groove of the anatomical neck of the os brachii. This section being made, we can readily dislocate the humerus forwards; then the knife may be easily insinuated behind the bone without touching the artery, which is contained in the pedicle which separates the two flaps; which pedicle is divided, after its base has been seized by an assistant, who compresses the artery.

In almost all the methods connected with that of Ledran, this last step of the operation, relative to the artery, should and may be retained, since we finish with the inferior flap.

That of MM. Champesmes and Lisfranc requires a narrow knife, and that the arm should be kept elevated, in order to separate the articular surfaces, and enlarge the space which the instrument must traverse. The edge of this knife must be directed upwards and forwards towards the summit of the acromion, in order that it may glide more easily between the glenoid cavity and the head of the humerus. When its point comes out behind the shoulder, we draw it forwards, first in the direction in which it is, in order that it may pass out from the joint; after which we decline the edge, so as to lengthen the external flap by grazing the external aspect of the os humeri.

That of M. Lisfranc demands the same precaution relative to the articulation; but it is also necessary to watch attentively the place at which the instrument is to make its escape, in order to avoid striking its point against the inferior aspect of the clavicle, or even propelling it behind this bone into the fossa supra-spinata. It is also important that it should not be depressed more than is necessary, for it would pass under the coracoid process into the *coraco-clavicular triangle* and divide the pectoralis minor.

Finally, the scapula forms a kind of shield behind and upon the side of the thorax. It covers the first six ribs and their inter-spaces, and corresponds to the thickest and most spongy part of the

lungs : but, although it is enveloped by numerous and thick muscles, the stethoscope applied, among other points, over its supra-spinal portion, will enable us to distinguish tolerably well the state of the respiration.

ART. II. *Of the Arm.*

We will divide the arm into anterior and posterior regions ; but will examine its general surface, previous to entering into those details which concern each of these regions.

Strictly speaking, the arm comprises all that part of the superior extremity which is occupied by the humerus ; but, as it regards topographical anatomy, the arm extends from the shoulder or axillary region to two inches above the elbow only ; in fat persons, and especially in females, the arm is conoidal. In general, it is cylindrical, and more or less flattened on its outer and inner surfaces. At its external and superior part it presents a triangular eminence, which is formed by the deltoid, and which is bounded, anteriorly and posteriorly, by two furrows which unite at its apex, in order to form the deltoidal depression : it is at this point that issues are usually inserted. From this depression another broad, but superficial, groove originates, which descends to the fold of the arm ; it represents the external aspect of the limb, and is the place upon which blisters are applied. A third furrow runs along the internal aspect, and extends from the hollow of the axilla to the elbow, where it joins the preceding. Between these two furrows, anteriorly, we observe an eminence, which is sometimes very prominent, bulging in the middle, disappearing in the axilla and fold of the elbow : this is the bicapital eminence. Posteriorly, the triceps also elevates the integuments in a greater or less degree, but does not form any important reliefs. We suppose the limb to be in the state of supination.

Sect. I. Anterior Brachial Region.

It is bounded, externally, by the *acromio-digital line* ; internally, by the *sub-scapulo-digital line* ; superiorly, by the hollow of the axilla, and inferiorly, by a transverse line which would unite

the two preceding two inches above the condyles of the humerus.

This region comprises the external and internal bicipital furrows, the eminence which separates them, the deltoidal depression, and a portion of the muscular relief which surmounts it.

CONSTITUENT PARTS.

I. *The Skin.*

It is delicate, white and very extensible, especially internally, supplied with but few sebaceous follicles and hairs, and entirely devoid of them upon the bicipital eminence. In the internal furrow we sometimes distinguish through it the basilic vein, and in the external, the cephalic. It moves easily over the organs beneath it; therefore, simple wounds which have their seat in this region, unless attended with considerable loss of substance, readily unite by the adhesive inflammation.

II. *The Sub-cutaneous Layer.*

This layer may acquire a very great thickness, and is generally thicker in women and children than in men; much thicker, also, in the depressions than upon the eminences. It is chiefly formed of cellular tissue, in the laminæ of which adipose vesicles are interposed, which agglomerate in small lobules in the furrows, and especially below the deltoid; it also envelopes a few nervous filaments externally, where they are derived from the musculo-cutaneous: more numerous internally, where we find the internal cutaneous and the filaments from the dorsal nerves. We also observe in it the trunks of the basilic and cephalic veins. All these parts are so disposed that the veins are more particularly enclosed in the deep-seated cellular laminæ, whilst the adipose cells are developed in the external lamellæ. The nerves generally lie upon the same plane with the veins; whence it follows that the distance of the latter from the skin is in proportion to the thickness of the adipose layer.

III. *The Aponeurosis.*

It is thin and almost cellular upon the median line, but this is owing to the splitting of the aponeurosis upon the external limits of this region ; then, one of its sheets only passes before the biceps muscle, whilst the other passes behind it over the anterior face of the brachialis internus. At the internal margin of the first of these muscles the deep sheet splits in its turn, and its two laminæ, in passing to unite with the internal surface of the superficial sheet, furnish a complete sheath for the humeral artery, its collateral veins and the median nerve. This sheath is generally continued as far as the axilla.

On the inner side of the arterial sheath there is another fibrous canal, which includes the internal cutaneous nerve and the basilic vein ; finally, as the aponeurosis enters the posterior region it receives, upon its internal surface, a fibrous intersection, which is very strong inferiorly, is attached to the internal ridge of the humerus, and may be called the *epitrochlo-humeral intersection*.

The brachial aponeurosis then is more complicated in this region than is usually admitted. Thus, it is thick externally, because its sheets are blended ; in the internal bicipital groove, it is still thicker, because there all its laminæ are conjoined ; it forms a sheath for the biceps the sheets of which are thin, because they seem to have been distended by this muscle, which is of greater or less volume ; a second sheath for the artery, the vein and nerve which accompany it ; and, in this sheath, lamellæ are detached forming secondary envelopes for each organ ; finally, a third for the internal cutaneous nerve and basilic vein, which, however, is not always present, neither is it prolonged so far upwards as the others. It is important to keep this arrangement in mind when about to tie the brachial artery.

IV. *The Muscles.*

We find in this region a small portion of the deltoid and coraco-brachialis, the greater part of the biceps and brachialis internus, the origin of the supinator radii longus and of the extensor carpi radialis longior muscles.

(a) The *Deltoid* here adheres very firmly to the bone, so that no fluid can collect beneath it ; its anterior border is enveloped by the aponeurosis, which is also very strong where it abandons it in order to enter into the axilla.

(b) The termination of the *coraco-brachialis* is much more posterior ; it is between it and the preceding muscle that the two portions of the biceps ascend to the shoulder.

(c) The whole of the *fleshy belly of the biceps* is observed at the anterior part of the arm ; its internal margin serves to guide us to the vessels ; superiorly and externally, it is covered by the deltoid ; it lies at first upon the humerus and the tendons of the coraco-brachialis, teres major and latissimus dorsi, afterwards upon the brachialis internus. Further, it is free under the skin in its aponeurotic sheath ; so that, in amputations, we must expect it to retract very much, especially as we generally divide it very far from its points of attachment. In order to render it most prominent it is necessary to extend the fore-arm : in this position, if the limb is fixed, and the muscle contracts, it tends to flex the humerus forwards. Consequently, in fractures of the arm, it may displace the fragments, in the first place according to their direction, and afterwards according to their length. It is for this reason that the fore-arm should be retained in a flexed position during the cure of these diseases.

(d) The *Brachialis Internus* is in a great measure concealed by the biceps, which it passes a little beyond, however, on each side ; so that the artery rests upon its inner portion, etc. It originates from the whole of the anterior surface of the os brachii, and also from the fore-part of the fibrous intersections attached to the borders of this bone ; superiorly, it is thinner and bifurcates so as to resemble the letter V, in order to embrace the apex of the deltoid. It is between the insertion of these two muscles, the biceps which is internal, and the triceps which is external, that we find the *deltoidal fossette*, which is also filled by cellular tissue and fat. This fossette then is so disposed, that the muscles which circumscribe it are not susceptible of moving or sliding over one another at this point ; and it is for this reason, as well as on account of the cellular tissue here met with, that we apply caustics upon this excavation.

As this musculè adheres to all the points of the bone which it

covers, and as its moveable point is situated upon the ulna, it follows that, in fractures of the inferior half of the humerus, it opposes rather than favours the displacement. From this disposition also, the brachialis internus cannot retract in amputations; therefore the biceps should be divided first, in these operations, in order that the knife may afterwards be carried as high as this muscle has retracted.

(e) There is only a *small portion of the supinator radii longus* in the anterior brachial region: it appertains to the elbow and fore-arm: it was necessary to note here, however, that it originates from the fibrous intersection on the inner side of the preceding.

v. *The Arteries.*

(a) *The Brachial Artery.* The relations of this vessel, from the tendon of the latissimus dorsi to its entrance into the region of the elbow, are the following: Enveloped in its aponeurotic sheath, it is always accompanied by the median nerve and the humeral vein or veins, so that we cannot attack one of these organs without running some risk of injuring the others; superiorly, the nerve is on the outer side of, or anterior to, the artery; lower down, the former crosses the latter very obliquely, passing almost always over its anterior surface, and sometimes only behind it: so that, inferiorly, it is almost uniformly upon its inner side. The cellular process which unites them in the interior of their common canal, is sometimes so dense that it affords a certain resistance to the needle with which we attempt to separate them. This nerve can scarcely be confounded with the arterial trunk; its volume, form, colour, consistency, and superficial position, do not permit us to commit this error: the vein, or rather the veins, for there are almost always two, are still more immediately applied upon this vessel; so that in the order of super-position it is only upon the third plane. When there is only one vein, it is on the inner side; if two, they are situated on each side, and sometimes they send, reciprocally, branches of communication which pass over the anterior face of the artery: it is then difficult to separate and exclude them, in the ligature of this artery.

If we consider it as divested of its sheath, of the median nerve

and collateral veins, the brachial artery rests posteriorly, from above downwards, upon the humerus, the tendon of the coraco-brachialis muscle, the fore-part of the internal portion of the triceps, and the brachialis internus; consequently, we may easily compress it against the bone in its superior third. Externally, it is still coated by the coraco-brachialis, then by the biceps; internally, it is separated from the triceps and the (*intermuscular*) ligaments, first by the radial nerve and internal collateral artery, afterwards by the ulnar nerve, which diverges from it more and more in proportion to its descent; and lastly, by the internal cutaneous nerve and basilic vein, enclosed in their sheath. The latter are more approximated to the artery above than below, and, in many subjects, the septum which separates the two fibrous canals disappears in the former direction. In its inferior fourth, it no longer has any relation with the triceps; it is the brachialis internus which then conceals its internal portion. Anteriorly, and more or less internally, it is covered by the aponeurosis, the superficial layer and the skin, throughout its whole extent; sometimes also the belly of the biceps inclines more or less in this direction; but, generally, in subjects of moderate embonpoint, whose muscles are not very large, the pulsations of the artery may be easily felt by applying the fingers along the internal bicipital furrow. Hence it follows that this artery may be surely discovered by making an incision upon the furrow just mentioned, in the direction of a line drawn from the hollow of the axilla, one inch before its posterior margin, along the inner side of the biceps, to the bend of the elbow. The skin being cautiously divided, on account of its tenuity, we perceive the cellular or superficial layer; this being incised, the edge of the knife sometimes comes in contact with some small veins, which it is convenient to avoid, and even the basilic vein, if it has not yet passed through the aponeurosis, which next comes in view: this last layer will present only one thick sheet, which will be easily traversed, if we have fallen directly upon the arterial sheath; but if, on the contrary, we have kept too close to the biceps, we will have to divide, first, the delicate expansion which covers this muscle, and afterwards the external part of the envelope of the artery.

Then will be exposed the median nerve and the vessels; per-

haps also the internal superficial vein and nerve ; but, in order to avoid mistaking the precise seat of the arterial trunk, it is sufficient to recollect that the median nerve is the first cord which we meet with in departing from the biceps muscle.

The *Arteria humeralis profunda superior*, or the great collateral, generally arises from the brachial a little below the *teres major* ; sometimes, also, it is derived from the subscapulary, circumflexi, etc., arteries. In either case, it immediately directs its course towards the interstice of the internal and middle heads of the triceps muscle, in order to enter the posterior region. Its volume is sometimes very considerable, and it is the principal branch for re-establishing the circulation after the ligature of the humeral. The application of this ligature should not, if possible, be made too near the *arteria anastomotica profunda superior* ; for then the blood cannot readily stagnate above the obliterated point, which will render the formation of the coagulum difficult.

(c) The *middle anastomotica (anastomotica magna)* is seen about the middle of the arm, and passes for some distance upon the *brachialis internus* previous to perforating the intermuscular ligament, in order to get to the posterior part of the arm. It follows the ulnar nerve in the same manner that the preceding accompanies the radial. Generally of small volume, it is sometimes very large, and may equal the size of the brachial. We must not forget the possibility of such a disposition when we perform any operation upon the internal part of the arm, in general, and upon the humeral artery in particular. It is also an additional reason for inducing surgeons to place the ligature rather near the aneurismal tumour than at a distance from it, when we operate upon this portion of the limb ; and it should likewise be recollected in amputation, in order that it may be secured.

(d) The *Nutrient Artery* of the bone (*Nutritia magna humeri*) is found towards the termination of the *coraco-brachialis* ; it generally traverses the tendon of this muscle, slides obliquely upon the humerus, and penetrates its osseous canal. It should be noticed, because when its volume is increased, as it is in most cases requiring amputation, if the section of the bone is made near the deltoidal impression, a considerable flow of blood may be the consequence. In fractures of this part of the bone it

may be lacerated, and give rise to extensive ecchymoses which it would be difficult to attribute to a wound of the veins.

It is not uncommon to see the origin of the inferior or internal collateral at the lower fourth of the anterior brachial region; but as it is still more frequently found in the region of the elbow, we will there examine it. As to the other branches given off by the humeral, they are too small and irregular to arrest the surgeon's attention.

The Brachial artery is sometimes double from its origin; at other times, from a more or less elevated point of the extremity only; then the two trunks may be of equal volume: more frequently one is smaller than the other; in which case the external is the largest: sometimes, but less frequently, it is the internal. Be it as it may, this anomaly might give rise to serious errors, if we were obliged to tie the humeral artery where it existed.

VI. *The Veins.*

They are superficial and deep-seated. The former are the Cephalic and Basilic.

(*a*) The *Cephalic* ascends parallel to the biceps on the fore part of the external furrow of the arm; it gradually inclines inwards, so as to enter the interstice which separates the deltoid from the pectoralis major (*coraco-deltoidal groove*); then it continues in the anterior region of the shoulder throughout the whole extent of this groove. The cephalic vein is situated external to the aponeurosis, enveloped in the deep laminæ of the subcutaneous layer; in the *coraco-deltoidal groove*, on the contrary, it is interposed in the laminæ of the fascia brachialis, which, in this place, is nothing more than cellular tissue more or less condensed. However, it follows from this difference in the relations of this vein with the aponeurosis, that it is always somewhat deeply seated superiorly; whilst, below the deltoid, it is so superficial that we see it through the skin, even in persons who are not emaciated. It seldom becomes varicose; nevertheless, some cases of this nature are recorded.* Strictly speaking, it is possible to open it with a lancet, throughout its whole course, with-

* Briquet, thèse 1824. Archives, 1825.

out danger. Inferiorly, it is only accompanied by some filaments of the external cutaneous nerve.

(*b*) The *Basilic* is situated in the middle of the internal bicipital gutter. It is at first enveloped in the laminae of the fascia superficialis, but, like the cephalic, afterwards abandons this layer, sometimes immediately above the elbow, at other times only when it is about entering the axilla in order to traverse the brachial aponeurosis, and empty into the deep-seated veins. Whilst it is cutaneous, it is surrounded by numerous filaments of the internal superficial nerve, and in the aponeurosis, we have already stated that it runs by the side of the trunk of this nerve, in the same manner that the humeral artery does by the median, and that it is included in a distinct sheath, separated by a partition from that of the artery: it is then, so to say, both superficial and deep-seated. Hence, when it inflames, it may give rise to a simple erysipelas in the lower part of the arm, whilst in its superior portion, it may occasion a general tumefaction. For the same reason it may determine the formation of abscesses between the aponeurosis and the integuments, and also give rise to them between the muscles; whilst the inflamed cephalic vein can only produce similar consequences in the subcutaneous layer.

The deep-seated veins were pointed out when speaking of the artery; we will only add here that, when we wish to obliterate the latter, we should carefully avoid comprising them in the noose, because their ligature is generally dangerous, from the phlebitis which it produces.

VII. *The Lymphatics.*

The superficial lymphatics abound in the bicipital furrows, where they are clustered around the cephalic and basilic veins. The latter in particular is accompanied by a very complicated lymphatic plexus, which remains in the superficial cellular layer until it reaches the cavity of the axilla. It is on account of the great abundance of absorbent vessels and cellular tissue which we find in the internal bicipital gutter, and even throughout the whole internal surface of the arm; it is because the skin is more delicate and sensible here than elsewhere, that we are advised to

apply medicinal substances upon this surface, with the view of introducing them into the general circulation.

The deep-seated lymphatic vessels form two or three bundles around the artery and veins: they are interrupted from the elbow to the axilla by glands, which seldom exceed four or five in number; very frequently there are none, and when they do exist, they are naturally very small. However this may be, it is necessary to recollect their exact position; for, if they enlarge gradually, they may contract adhesions with the artery, and impose upon us for aneurisms. We have twice met with a single lymphatic gland in the upper part of the deltoidal fossette. In both cases it was of the size of a large lentil, and the vessels passed towards it in a convergent direction: it was external to the aponeurosis.

VIII. *The Nerves.*

(a) The relations of the *median* were pointed out above, when speaking of the artery.

(b) The *musculo cutaneus*, or external cutaneous, instead of perforating the coraco-brachialis muscle, sometimes remains for a considerable time upon the external side of the artery; and in this case, if we were not attentive, it might be mistaken for the median nerve. Be this as it may, it enters into the sheath of the biceps, and is soon found on the outer side of this muscle opposite to the cephalic vein, from which, however, it is separated by the aponeurosis as far as the inferior part of the region.

(c) The *Internal Cutaneous*. Next to the median, this lies nearest to the artery. Situated upon a plane a little more anterior, it follows the external border of the basilic vein, runs with it into its canal, and escapes, at the same time with it, from the aponeurosis. In its course it gives off numerous filaments to the superficial layer. It is sometimes of considerable volume, so that at the first glance it might be mistaken for the median; but this error would soon be corrected by referring to the biceps muscle.

(d) The *Ulnar Nerve* is placed upon the internal side of the brachial artery before the triceps muscle, by which it is enveloped almost from its commencement, and which it traverses about the

middle of the arm, in order to get into the posterior region, be-
 hind the *epicondyllo-humeral intersection* (intermuscular liga-
 ment).

(e) The *Radial* is still more posterior and more external. It follows the direction of the great collateral artery of the arm, that is to say, it turns round the humerus between the heads of the triceps, abandoning almost immediately the region in which it originates. It is most frequently the largest of all. The volume of the nerves of the arm would be pretty accurately graduated in the following order: 1st, The *Radial*; 2d, the *Median*; 3d, the *Ulnar*; 4th, the *Musculo Cutaneus*; 5th, the *Internal Cutaneus*.

We also have here the nervous filaments which come from the intercostal nerves, and which are entirely lost in the superficial layer, upon the internal surface of the arm. These twigs establish a certain sympathetic relation between the arm and the organs contained in the thorax; a relation to which many physicians have ascribed considerable importance, when they have endeavoured to explain the revulsive action of blisters applied upon the superior extremity in diseases of the thorax.

IX. *The Skeleton.*

It is formed by the anterior part of the humerus, which is slightly curved in this direction, rounded and prominent above, and which gradually grows broader as it descends. It is between the point of insertion of the *latissimus dorsi*, *coraco-brachialis* and *pectoralis major*, that this bone may serve for the compression of the artery, as it is there prevented from rolling under the fingers by these muscles. To its anterior surface the *coraco-brachialis*, *deltoid* and *brachialis internus* are attached. But we will examine the different peculiarities which concern this bone with more advantage, when we come to speak of the posterior brachial region.

Sect. 2. Posterior Brachial Region.

This region is much less complicated than the preceding, and of minor importance in surgery. In its superior portion it pre-

sents a part of the deltoidal eminence and of the posterior groove of the same name : as for the rest, it is rounded and convex.

CONSTITUENT PARTS.

I. *The Skin.*

This layer is compact, thick, rugous, and much less extensible than on the fore part of the arm ; it is also darker, and contains many piliferous bulbs and a great quantity of sebaceous follicles. It is these bulbs and follicles which sometimes give to the skin that irregular and rough appearance, vulgarly called "*goose-flesh*," which manifests itself in consequence of some violent mental impression or sudden exposure to cold. Boils frequently occur in it.

II. *The Subcutaneous Layer.*

It is less complicated and always much thinner than anteriorly ; includes only a small number of vascular and nervous twigs, and but few adipose vesicles. Consequently, the cellular is almost the only tissue which exists in it ; it is lamellated, and its lamellæ, more or less compact, sometimes form a complete fascia superficialis. From the compact texture of the skin, and the slight adhesion of the cellular layer, pus burrows under these parts with the greatest facility and with difficulty makes its escape externally : hence we should open abscesses, occurring in this region, at an early period.

III. *The Aponeurosis.*

This is generally thicker than upon the fore part of the biceps, but thinner than in the brachial gutters. Its fibres are principally transversal. It is continuous, superiorly, with the tendon of the latissimus dorsi, which may be considered as its tensor ; inferiorly, where it passes upon the anterior region, it receives the fibrous intersection which originates from each side of the humerus, and it is then that these intersections form two species of ligament. Elsewhere, it consists of one sheet only, except as it approaches

the internal intersection, where its laminae split in order to envelope the ulnar nerve.

IV. *The Muscles.*

Properly speaking, this region includes the Triceps only. That portion of the deltoid which is observed in the upper part, can give rise to no further remarks than have been made in the preceding regions. It is necessary to note that, superiorly, the fibres of the triceps are nearly parallel to the direction of the bone; whilst inferiorly they run obliquely from the median line towards the sides: they are connected to the aponeurosis by means of a very supple lamellated cellular tissue, which easily inflames and sometimes gives rise to severe symptoms, owing to the resistance which the aponeurosis opposes to the accumulation of the fluid. Its anterior surface is attached to almost the whole length of the bone, and this is a very important circumstance to note, both in relation to amputations and fractures. When we amputate the arm, for instance, if we wish to make two flaps, after the manner of Vermeil or Ravaton, the triceps will accommodate itself to this method; but as the biceps is entirely free on the fore part of the arm, it will retract too far, and will form too round a mass for the flap to be sufficiently regular on this side.

If we operate by the circular method, as the biceps alone is capable of retraction, it is useless, with the view of preventing the projection of the bone, to dissect up the skin, as was done by Petit and Cheselden. It is sufficient for the assistant to draw up the skin firmly, whilst we cut it and divide the cellular bridles which retain it upon the triceps, in order that this muscle may be incised sufficiently high up.

In fractures which occur lower down than the insertion of the deltoid, as the triceps is attached to the two fragments, which are enveloped by it, it is incapable of producing displacement; on the contrary, like the brachialis internus, it always tends to maintain them in contact; therefore these kinds of fractures are rarely followed by much over-lapping, unless they are very oblique, or the fracturing cause has continued to act after the fracture of the bone.

v. *The Arteries.*

These vascular branches are few in number, and are all derived from the humeral artery; they only merit our attention on account of the anastomoses which establish a communication between them and the collateral arteries of the fore-arm, and which re-establish the circulation after the obliteration of the brachial artery. We find in this region the great collateral (*profunda*) which turns round the humerus, first between the internal and scapulary bundles (*short and long portions*) of the triceps, then before the latter, afterwards upon the external (*longer*) portion, in order to terminate in the vicinity of the epitrochlea (*internal condyle*). All the ramuscles which it gives off in this track are lost in the triceps. It is seldom that any of them are so large as to require a ligature after amputation: but the collateral must be carefully tied. In this case we should not forget that it is accompanied by the radial nerve, in order to exclude this cord from the ligature.

The other branches are derived from the arteria profunda media and the internal collateral (*anastomotica magna*); they inosculate a great number of times with those just mentioned, and are too small to require any particular precautions in operations; so that if we amputate the arm some inches above the elbow, it will scarcely ever be necessary to tie more than the brachial artery and the great anastomotic; if, on the contrary, the operation was performed in the middle of the limb, hæmorrhage might take place from the brachial, profunda superior (*external collateral*) and media, and even from the arteria nutritia of the bone; and from this circumstance it is necessary to recollect the exact position of these arteries.

vi. *The Veins.*

They have the same disposition with the arteries, are not superficial, nor susceptible of any particular surgical applications.

VII. *The Lymphatics.*

Almost all of them pass into the internal bicipital furrow, are few in number, and, so far as is known, destitute of glands in this region.

VIII. *The Nerves.*

(a) The *superficial filaments* are small and few in number; they appertain almost entirely to the internal cutaneous and dorsal branches: externally, in fact, scarcely any of them are furnished by the external cutaneous nerve.

(b) The *Ulnar* (Cubital) is the most remarkable; it only enters into this region towards the inferior third of the arm. It then runs between the brachialis internus and triceps, and the aponeurosis furnishes it with a process which is converted into a canal by the internal fibrous intersection; after which it takes its course, surrounded by this sheath, along the inner border of the arm, and in so superficial a situation that it is very much exposed to injury.

(c) The *Radial*, which is likewise very large, gives several branches to the different portions of the triceps, and exactly follows the course and distribution of the deep humeral artery until it arrives opposite to the origin of the supinator longus, where it traverses the external fibrous intersection, in order to penetrate into the anterior region between this muscle and the brachialis internus. This nerve, resting immediately upon the humerus, is more exposed than all the others to be stretched or torn in fractures which take place below the neck of the bone.

IX. *The Skeleton.*

This is formed by the body of the os brachii, which is the narrowest part of the bone, and consequently is more disposed to yield to the action of indirect causes of fractures; and as blows, falls, etc., have a greater hold on it than upon the extremities of the bone, it follows that its fractures must be very frequent.

In consequence of the muscular insertions, these solutions of

continuity may be arranged in three orders:—1st, In those which take place between the deltoid and teres major, the parts are so disposed that the inferior fragment is drawn forwards and outwards by the biceps and deltoid, and downwards by the long portion of the triceps; whilst the coraco-brachialis, latissimus dorsi, teres major and pectoralis major, tend to draw the superior fragment inwards. It is in this species of fracture that the displacement may be carried to the greatest extent, and it seldom fails to take place.

When the fracture occurs towards the deltoidal depression, the superior fragment is abandoned to the deltoid and to the muscle of the shoulder, which draw it outwards and forwards. The inferior end remains under the control of the brachialis internus, which then takes its fixed point from the ulna. The biceps and the long portion of the triceps, in this case, counteract each other.

Finally, in the third case, that is where the fracture takes place near the inferior third of the region, the two fragments are found simultaneously enveloped by the brachialis internus and the triceps: so that it is very rare to see the muscles alone produce the displacement.

ART. III. OF THE ELBOW.

Under this title we comprehend that portion of the superior extremity which is circumscribed, superiorly, by the circular line which forms the inferior boundary of the arm, and inferiorly by another circular line drawn three inches below the humeral condyles. This part, like the arm, will be divided into anterior and posterior regions.

Sect. 1. Anterior Region of the Elbow; or Fold of the Arm, (Vide Plate 6.)

This region is very important with respect to venesection, and aneurisms which frequently have their seat in it. Its surface presents, superiorly, the termination of the bicipital prominence; externally and internally, two other muscular eminences, which converge towards one another and at length become conjoined at their entrance into the anti-brachial region. These last are sepa-

rated, superiorly, by the first prominence, and inferiorly by a triangular depression of greater or less depth. This excavation, which is prolonged upon the fore-arm, forming a simple groove, results from the reunion of the two bicipital gutters, which are blended between the three eminences just mentioned.

CONSTITUENT PARTS.

I. *The Skin.*

It is delicate and white, especially in the gutters and the median excavation, as well as upon the bicipital prominence; it is also covered with some hairs upon the lateral eminences, where it contains more sebaceous follicles than in the other points of the region. As it receives a great number of nervous filaments and blood vessels, it readily inflames, and frequently becomes the seat of small phlegmons, or of erysipelas.

II. *The Subcutaneous Layer.*

This layer is, if I may so say, composed of two sheets: one, deep-seated, a species of aponeurosis, in the laminæ of which are the subcutaneous nerves and vessels; the other, superficial, constituted principally of adipose cells, and variable in thickness. In emaciated individuals, the latter sheet scarcely exists, whilst the other is then thicker and more firmly adherent to the skin. This deep-seated sheet, thicker in the gutters than upon the eminences, penetrates, in accompanying the deep median vein, between the pronator radii teres and the supinator longus, in order to become continuous with the intermuscular cellular plates and the cellular tissue surrounding the articulation.

It is in the subcutaneous layer that phlegmonous erysipelas has its seat; and hence we may conceive with what facility the inflammation and pus may traverse into the neighbouring regions.

III. *The Aponeurosis.*

In thin adults, whose aponeuroses are strong and well delineated, the following is the natural disposition which that of the fold

of the elbow presents : it is merely a continuation of that of the arm ; but as it is excessively complicated, it requires to be examined in its several points separately. On the outer side of the biceps, the superficial sheet, which covered the inferior portion of this muscle, passes upon the anterior face of the external muscular eminence ; and where it dips, the deep-seated sheet is also applied to it, down into the external furrow. There the aponeurosis is thicker, and its laminæ soon separate in order to envelope the supinator longus muscle ; lower down, the deep-seated sheet only persists in the median excavation, where it is found strengthened by a lamina of greater or less thickness, which is detached from the tendon of the brachialis internus. As it descends, this deep-seated sheet rises again, so that it passes between the radiales and supinator longus, on the one part, and, on the other, expands upon the anterior face of the latter muscle, becoming blended with the superficial sheet ; finally, at the inferior part of the region, these sheets again approximate, and it is between them that we meet with the radial artery, vein and nerve.

On the inner side of the biceps, the superficial sheet, stronger than on the outer side, spreads obliquely over the internal muscular eminence. The deep-seated sheet, which is still thicker, is also derived from the internal and inferior part of the brachialis internus : as it ascends, its fibres are directed obliquely inwards and upwards ; it splits occasionally in order to envelope the basilic vein, which also sometimes passes between this and the superficial sheet. As it descends, it likewise unfolds, and one of its laminæ rises over the fore part of the pronator radii teres, where it blends itself with the superficial sheet, whilst the other dips down between the muscles. The bandelet which is detached from the external margin of the tendon of the biceps, passes between these laminæ, in the first place, without adhering to them, but afterwards becomes confounded with them upon the internal muscular eminence.

From what has preceded, it follows that the diverse laminæ of the anti-brachial aponeurosis are principally attached to the tendons of the biceps and brachialis internus, and consequently that, when these muscles contract, they must stretch the fibrous sheet sheath now under consideration. It also follows that an aponeurotic aperture seems to exist in the middle of the fold

of the arm. This opening bears a very great resemblance to that in the fascia lata femoris; it resembles it in its dimensions, in its oval form, by its largest extremity being downwards, by its internal semi-circumference which is better defined than the external, by the vessels and nerves observed in it, and lastly, by the cellular lamellæ which close it, and sometimes prevent its being clearly distinguished. It commences, in general, some lines above that portion of the biceps which sends off the fibrous bandelet to the aponeurosis, and terminates about an inch below this expansion. We observe in it, superiorly, the tendon of the biceps, and on the inner side of it, when the aperture is considerable, the brachial artery and median nerve, the origin of the fibrous bandelet, the external border of which sometimes forms the internal semi-circumference of this circle. Lower down than the biceps we still observe the brachial artery, the origin of the radial and ulnar, their venæ comites, the communication of the median veins with the brachial vein, the median nerve, the tendon of the brachialis internus, and lastly the median basilic and median cephalic veins, which pass before this aperture.

It is important to note here that the bandelet given off from the inner margin of the bicipital tendon merits, in relation to the artery, the greatest attention. In fact, it uniformly crosses the anterior aspect of this vessel, as it is passing upon the muscles of the fore-arm; so that the humeral artery may be secured below this bandelet, before it divides into the radial and ulnar, and we may also tie it above it, without being obliged to separate any thing but cellular tissue.

Upon the external muscular prominence the aponeurosis of the fold of the arm is very simple and does not adhere to the muscles; internally, on the contrary, it is firmly connected to the muscular bundles, sends intersections between them and is blended with their tendinous origin upon the fore part of the *epitrochlea* (internal condyle). In the bottom of the bicipital aperture, it passes back to the articulation of the elbow, and is there continuous with the ligaments.

IV. *The Muscles.*

They may be arranged according to the three principal eminences of the region.

(a) In the *median muscular eminence*, we find the *termination of the biceps*; the tendon of this muscle, applied upon the *brachialis internus*, makes a turn as it dips into the hollow of the elbow, in such a manner as to form an arc of a circle the convexity of which looks forwards, inwards and downwards. Between this tendon, the fibrous bandelet which it gives to the aponeurosis, and the *pronator teres* muscle, exists a small triangle, in which we see the brachial vessels and the median nerve; and it is upon the fore part of this triangle that the basilic vein corresponds to the brachial artery. Lower down, and always on the inner side, the internal muscular eminence partly conceals the tendinous extremity of the biceps, at the moment of its insertion into the tubercle of the radius: when this tendon abandons the *brachialis internus* it is reflected back, so that one of its surfaces looks inwards whilst the other is inclined outwards, and twists upon itself in the latter direction, in order to pass upon the radius.

From this disposition it follows that, in the physiological state, the biceps tends, in the first place, to roll the radius outwards and consequently to produce supination; afterwards to flex the fore-arm, if its action continues after the rotation has been effected. It must be observed, in relation to the movement of flexion, that this muscle acts upon a lever of the third order, and that it is inserted in a manner very unfavourable to this motion, since the insertion is very near the fulcrum; but that on the other hand, the species of pulley which the *brachialis internus* muscle forms for it behind, by enlarging the angle under which it is fixed to the radius, partially compensates for the unfavourable disposition just indicated.

In the pathological state, in luxations of the fore-arm backwards, for example, this muscle counteracts the action of the triceps and tends to produce flexion. In fractures of the upper third of the radius, the biceps also draws the superior fragment forwards and towards the median line of the limb: whence the necessity of keeping the fore-arm flexed, in order to maintain the surfaces in contact.

Next the *Brachialis internus* (*brachial anterieur*), which forms the bottom of the two lateral furrows. It is covered in the middle by the biceps and its tendon, by the radial and musculo-cutaneous nerves; by the median cephalic vein, in the external

gutter, and, on the outer side, by the external muscular eminence. Internally, the brachial artery and median nerve rest upon its anterior surface, which dips a little under the pronator radii teres; its posterior surface covers the whole of the fore part of the articulation, without adhering to it. This muscle is separated from the anterior face of the humerus by a considerable quantity of very lax lamellated cellular tissue. When this cellular tissue becomes inflamed, it frequently gives rise to deep seated abscesses, which promptly occasion disorganization of the bone. The very strong and very thick tendon of the brachialis internus, in descending upon the coronoid process, does not attach itself to it, as is too generally repeated, but simply covers this eminence, and is evidently inserted into that crest which connects its anterior border with the internal border of the ulna. In this manner the insertion of the brachialis internus descends to a level with the tubercle of the radius. Hence it follows that this muscle really acts upon the body of the bone, and that the apophysis answers for it the purpose of a pulley; which is much more favourable for its action.

(b) The *external muscular eminence* includes the supinator longus, the extensor carpi radialis longior and brevior, and the supinator radii brevis. The first of these muscles is the most important in a surgical point of view; in fact, it is under its inner margin that we find the radial artery; it is between it and the brachialis internus that the radial nerve descends in the median excavation of this region; and it is beneath it that this nerve divides into anterior and posterior branches. From its originating pretty high upon the humerus, even in the brachial region, and from its direction, it seems that this muscle is better adapted to act the part of a flexor than a supinator of the fore-arm, which appears more properly to belong to the biceps. When the humerus is fractured below the deltoid impression, the supinator longus acts like the brachialis internus upon the lower fragment. The same may be said of the extensor radialis longus: the latter and the brevis, being more particularly applied upon the *epicondyle* (external condyle), to which they are attached, and upon the small head (*eminentia capitata*) of the humerus, become the principal causes of displacement in fractures of this part of the os brachii. As for the rest, they present nothing very remarkable

in this region; they are separated, below especially, from the supinator longus and radial artery, by a fibrous, or simply cellular process, according to the subject.

As the supinator brevis adheres to the epicondyle and ulna, envelopes the humero-cubital articulation and almost all the superior fourth of the radius, it constitutes a power which, on the one hand, opposes luxations, and, on the other, displacement of the fragments when the upper part of this bone is fractured: in this respect, it is the antagonist of the biceps, for the tendon of which there is a notch in its internal margin. The posterior branch of the radial nerve passes through its fibres into the posterior region of the fore-arm.

(c) The *Internal Muscular Eminence* contains the greatest proportion of muscles; but as all these muscles are blended upon the *epitrochlea*, it is not necessary to examine each of them separately. This mass then is composed of the pronator teres, flexor carpi radialis, palmaris longus, flexor sublimis, flexor carpi ulnaris and flexor profundus. All these muscles are united by fibrous intersections, among which there is one which will be of great assistance to us in finding the ulnar artery in the fore arm: it is that which is situated between the flexor ulnaris and flexor sublimis. The pronator teres is the only one which deserves particular attention; it is below it that the ulnar artery and median nerve insinuate themselves, in order to escape from the fold of the arm through one or more apertures which result from the separation of its fibres; it is before its tendon that the radial vessels and nerves are placed as they descend upon the fore-arm. As this muscle derives its fixed point from the humerus, and as it passes obliquely upon the radius, it follows that its action appertains entirely to the latter bone; which in the natural state produces pronation; but in fractures this disposition is very disadvantageous; for, whether the fracture of the radius is above or below the insertion of the pronator teres, whether the bone is broken obliquely or transversely, it will always tend to obliterate the interosseous space, by drawing one of the fragments towards ulna.

v. *The Arteries.*

(a) In the fold of the arm we find; first the *humeral*, which descends to it obliquely outwards and backwards, in the bottom of the internal bicipital furrow. It does not generally divide until it arrives at the tubercle of the radius. Enveloped in the laminæ of the deep-seated sheet of the aponeurosis, the humeral artery is covered, from above downwards, by the superficial sheet, by the fibrous slip of the biceps, and more inferiorly by some cellular tissue only. Anterior to these sheets, it corresponds to the median basilic vein and internal cutaneous nerve; it rests upon the brachialis internus, then upon the tendon of the biceps, to which it sometimes adheres: whence it follows that in carrying the arm in forcible pronation, the artery, being drawn by the tendon, is thus separated, by a greater space, from the median vein. Along the inner side of the humeral artery the median nerve always runs, which may also be placed behind it; more internally and inferiorly, it is in relation with the pronator teres muscle; externally, it runs by the side of the biceps, crosses the inner margin of its tendon, and terminates by being free in the median excavation.

In consequence of these relations it is necessary, when about to tie the brachial artery at the fold of the arm, to proceed differently, according to the point at which we wish to expose it. If the operation is performed above the articulation, it would be necessary to divide, in the internal bicipital groove, the integuments and the fascia superficialis, to separate the basilic vein and the cutaneous nerve, and to cut through the aponeurosis, which is frequently double at this point, when the artery will be met with between the median nerve, the accompanying vein and the biceps muscle.

If, on the contrary, we seek for it in the bend of the arm, the incision should be made parallel to the external border of the internal muscular eminence; the instrument will then divide the skin and the subcutaneous layer, when the only covering of the artery will be the cellular tissue. If we wish to expose it below the fibrous *bandelet* of the biceps, that is to say in the small triangle indicated when on the aponeurosis, we should recollect

that, at this point, the artery, nerve and tendon are very closely approximated, although always in the same relations, and that the aponeurosis, strictly speaking, no longer exists before them. If, finally, we wish to sieze it a little higher, it will be necessary to cut through the superficial sheet of the aponeurosis and the *bandedet* of the biceps.

It is necessary to note that aneurismal tumours at the fold of the elbow are developed differently, according to the point which they occupy. If they exist beneath the bicipital fibrous bandelet, the aponeurosis will not oppose any resistance to them inferiorly, anteriorly and externally, but it will afford much, inwards and upwards; the muscles and the fibrous sheets will always hinder them from increasing in this direction. Consequently, if we operate upon an aneurism at the elbow and the tumour is seated below the biceps, we would expect to find the opening of the vessel upwards and inwards. If the disease is situated immediately above this *bandedet*, and the aperture which was mentioned when speaking of the aponeurosis is prolonged in this direction, the tumour will become engaged in it, and will remain globular and perhaps appear pediculated; if the artery had been wounded or diseased under the fibrous bandelet, it is presumable that the sanguineous tumor would still pass through this aperture and project beneath the skin.

Finally, if the aneurism forms in the superior part of the region, it will remain flattened for a longer period; it will project less readily, externally; the tumour will be less moveable, because the aponeurosis, equally applied over the whole anterior surface of the sac, will more firmly resist the distending effort of the blood, and, from this circumstance, it will be less easy to mistake the nature of the disease at this point than in the two preceding.

It is not uncommon for the brachial artery to bifurcate higher up than has been stated; which is the reason why it is preferable to apply the ligature above the elbow than at the fold of the arm, even when the seat of disease will admit of a choice. This bifurcation may take place upon the tendon, below its *bandedet*, which disposition enters into the normal state; but if higher than this bandelet, in any point whatsoever of the rest of the region, it is then a decided anomaly. In the latter case, the two branches may remain by the side of one another, between the biceps and

the median nerve, and enter together into the fold of the arm ; or the median nerve may be situated between the two branches, the external passing before the tendon of the biceps, in order to get under the supinator muscle and form the radial, without descending to the bottom of the middle excavation of the elbow, whilst the internal glides, as usual, under the pronator teres to constitute the ulnar. This is a circumstance which might be attended with danger in phlebotomy, if we did not pay attention to it. It may also happen that the internal branch remains at some distance from that which is on the outer side of the median nerve, and, instead of plunging under the internal muscular eminence, passes before it in order to form the ulnar, which is then subcutaneous ; in this case, this internal branch is generally only the inferior collateral (anastomotic) greatly developed. Finally, we have seen the brachial artery divide very high up, and in such a manner that one of its branches descended upon the external side of the biceps, in order to constitute the radial, sometimes running under the supinator longus, as in the normal state, and at others, external to the aponeurosis, immediately beneath the skin.

The simultaneous existence of two humeral arteries being a very common anomaly, the ancients had observed it, and, by this knowledge, endeavoured to account for the cure of aneurisms at the fold of the arm by the obliteration of the artery. They in fact preferred supposing that two arterial trunks existed in the limb, to admitting the possibility of the circulation of the limb being supported after the ligature of the brachial artery. But the researches of the celebrated Scarpa have corrected this error.

(*b*) The *ulnar (cubitale)* seems to be the continuation of the preceding. Immediately after it separates from the radial it dips under the internal muscular eminence, traverses the pronator teres, runs obliquely downwards and a little inwards, and places itself between the flexor sublimis and profundus. We see that it would be very difficult to discover it at the fold of the arm, in the usual state of conformation : therefore, when it is necessary to obliterate it, it is more prudent and certain to take up the brachial.

(*c*) The *Radial* is generally smaller than the ulnar, and lies pretty deep at first, but rises a little as it passes outwards and

forwards, under the supinator longus, in order to follow the middle furrow of the fore-arm. This artery consequently becomes more and more superficial as it descends; so that immediately below its origin it corresponds to the aponeurotic aperture, and is only separated from the radius by the supinator brevis, the tendon of the biceps and some cellular tissue. Anteriorly, it is separated from the integuments by several fibro-cellular laminae and the superficial layer. From these circumstances, we might discover it by making an incision upon the external margin of the pronator teres; but the operation would not fail to be rendered difficult by the elevation of the muscular eminences, by the presence of the median cephalic vein and that of the external cutaneous nerve, which we would frequently be obliged to divide. As for the rest, the radial nerve is then several lines external to it. Below the aponeurotic aperture, the radial artery is placed upon the pronator teres, between two thin fibrous laminae, having on its inner side the flexor carpi radialis, on its outer, the supinator longus, the internal margin of which usually advances some lines before it. Then the nerve approaches so close to it that we might strike it previous to its entrance into the anterior anti-brachial region: we would therefore have to divide the skin, the subcutaneous layer and the aponeurosis, which will present two sheets before the artery, if the instrument is directed upon the supinator, and only one, but thicker, if it is inclined more towards the median line. Besides, the middle median vein and the principal branches of the musculo-cutaneous nerve should be drawn outwards, as well as the border of the supinator longus muscle. Then the radial artery will be easily distinguished between its nerve, which is external, and its collateral veins.

(d) The *Interossea* arising from the ulnar at the moment that it enters between the two muscular layers of the fore-arm, it would scarcely be possible to apply a ligature around it. It is seated too deep to be frequently wounded.

(e) The *recurrens radialis anterior* most frequently arises from the trunk of the humeral on the inner side of the tendon of the biceps, upon which it turns in order to pass into the external furrow of the region. As this branch ascends, it runs between the two portions of the radial nerve, between the bra-

chialis internus and the extensor radialis longus, places itself before the condyle, and goes to inosculate with the external collateral. It is sometimes so large that we should be apprehensive of placing a ligature immediately below it upon the humeral artery.

(*f*) The *Internal Recurrents* (*Recurrentes Ulnaris*) originate from the ulnar; the anterior glides along the bottom of the internal bicipital furrow, between the brachialis internus and the inner muscular mass; it ascends before the epitrochlea, above which it anastomoses with the inferior collateral of the arm. The posterior recurrent passes between the flexor sublimis, flexor profundus, and flexor carpi ulnaris, in order to pass behind the epitrochlea, etc.

(*g*) Finally, the *internal or inferior Collateral* of the arm (*ramus anastomoticus magnus inferior*) is also given off by the brachial in the region under consideration; it is generally detached from the trunk an inch or two above the internal condyle of the humerus, and as its calibre is very considerable in certain subjects, it is necessary to pay attention to it in operations. It is by means of its anastomoses with the recurrent arteries that the circulation in the fore-arm is re-established when the humeral artery is obliterated at the fold of the elbow. We have previously stated that it sometimes supplies the place of the ulnar, in which case it is generally very superficial. We know a physician in whom this disposition is so evident, that the pulsations of this artery are very perceptible through the skin, from the inferior third of the arm to the middle of the fore-arm.

VI. *The Veins.*

The superficial veins are the most important of the region; their volume is considerable, and by their communications with one another they form a species of plexus; they are:

(*a*) The *Cephalic*, which is situated upon the radial side of the region, in the laminæ of the subcutaneous layer, upon the external muscular eminence. As this vein is passing from the anterior face of the supinator longus upon the side of the biceps, it receives the median cephalic and the anterior radial. The external cutaneous nerve runs by the side of it, but in such a manner that the former is separated from it, in the arm, by the

aponeurosis, as far as almost an inch above the *epicondyle*; and upon the external muscular mass there are only some small nervous branches around the vein: therefore, in relation to nervous accidents, bleeding from the cephalic vein is less dangerous than that from the others, and the higher we open the vein the less cause will we have to apprehend such accidents after this operation.

(*b*) The *Basilic* is situated upon the ulnar side of the bend of the arm; it passes before the *epitrochlea* in order to arrive at the internal bicipital furrow, from whence it proceeds into the brachial region. At first it is superficial, like the preceding; that is to say, that upon the fore-part of the internal muscular eminence, it is included in the laminæ of the subcutaneous layer; but as it ascends it gradually becomes deeper. When opposite to, or a little above the *epitrochlea*, as it is entering the internal bicipital groove, it tends to insinuate itself between the laminæ of the brachial aponeurosis, which soon furnish for it a complete sheath. It is accompanied by the internal cutaneous nerve, included in the same aponeurotic sheath, and, above the muscular eminence, almost always situated upon its inner side: lower down, the principal branches of this nerve continue to follow the vessel, but sometimes internal to, at other times crossing before it; and again they are behind, or upon its outer side. Occasionally they form around it a species of plexus: in short, these nervous filaments are so disposed relatively to the *basilic*, that it is scarcely possible to open this vein without running the risk of wounding them. In this respect, anatomical knowledge and the precautions which we might take will be but of slight assistance, on account of the numerous varieties in the relative position of these organs. On the one hand, if the operation is performed upon the side of the biceps, we will perhaps avoid the principal nerve by puncturing the vein from the external towards the internal side; but if we should strike it, its volume in this place is so considerable, that pretty serious symptoms might be the consequence; besides, the vein being deeply situated, it would not always be easy to reach it. On the other hand, if we bleed upon the eminence of the anti-brachial muscles, the nerves are indeed smaller, but if they escape the instrument it will be by chance alone. Venesection.

therefore, from the trunk of the basilic should not be performed when we can do otherwise.

(c) The *Median* is actually the most important, in a surgical point of view, of the three veins at the fold of the elbow. We generally meet with it in the lower part of the region, in the median groove, occasionally inclined upon the external eminence, sometimes also more internally; it is almost always single, and thus ascends as far as the aperture of the aponeurosis. There it divides into three branches; one, very short, which almost immediately empties itself into the deep-seated veins, in the same manner that the saphena major does into the femoral. The other two remain superficial, follow the two grooves of the fold of the elbow, passing upon the sides of the biceps in order to enter, the one into the basilic, and the other into the cephalic; so that, in the regular conformation, these two branches, with the two trunks into which they open, represent somewhat the letter M. The *median basilic vein* consequently runs along the outer side of the internal muscular eminence, becoming deeper and deeper in proportion to its ascent: it is surrounded by some twigs of the internal cutaneous nerve, and these sensitive filaments, in general of small size, are pretty uniformly situated before the vein. Its direction is such that it crosses the artery, which is behind it, very obliquely; but this direction is susceptible of numerous varieties; so that in some subjects the vein is almost parallel to the artery, whilst in others it crosses it at a considerable angle. In the latter case, which is fortunately the most frequent, we run less risk of wounding the arterial trunk by making the puncture near the extremities of this vein. In the other, the dangers are almost always the same, at whatever point we may choose; however, as the artery lies deeper superiorly and inferiorly than in the middle, we should prefer one of the two former points, the second especially. The median basilic is nevertheless always separated from the humeral artery by fibrous or cellular laminae, according to the place at which we examine it. Thus, anterior to the tendon of the biceps, and below the *bandelet* which it furnishes to the aponeurosis, these vessels are separated by a lamellated cellular tissue only, which there forms a layer the thickness of which varies in proportion to the embonpoint of the individual; whence it follows, that, in fat persons, we may introduce the

lancet very deeply without striking the artery ; whilst in thin subjects it will often be difficult to avoid it. Hence it is in the latter case that we most frequently see aneurism consequent upon bleeding. One of three things may then happen : 1st, either the instrument will traverse the vein from one side to the other and penetrate the anterior paries of the artery, making a large opening in it : in this case the blood will be immediately thrown out in jets, and will only be stopped by the suspension of the circulation in the limb ; a suspension which may be produced by syncope, but for a few moments only, by the ligature of the artery above the elbow, or by pressure above the puncture or upon the wound itself. It is, in general, when we have attempted the latter method that the blood extravasates into the cellular tissue, and produces the *false, primitive, or diffused aneurism* :—2d, or the point of the lancet will have wounded the artery very slightly, and the accident will not be detected at the time of the operation ; the wound of the vein and of the cellular covering of the artery will cicatrize : but the internal and middle arterial tunics being insusceptible of agglutination when they have been divided, the impulse of the blood will not delay to give rise to a tumour at this part, constituted by the fluid which will be extravasated in a cyst furnished by the cellular tunic : it is in this manner that the *false consecutive, or circumscribed aneurism* is formed, on the fore-part of which the veins usually remain applied. This form of aneurismal tumour is developed as frequently when, after the artery has been pricked in bleeding, compression has been made upon the wound ; then, in fact, the hæmorrhage may be suspended, and the patient apparently cured ; but after a certain period, in consequence of some exertion, some sudden movement, or even without any appreciable cause, the lips of the arterial wound separate and the aneurism forms :—3d, or lastly, the corresponding parietes of both vessels are so exactly applied against each other that, after the cicatrization of the subcutaneous wall of the vein, the red blood passes into the latter by the opening which is common to it and the artery, and thus forms the disease so well described by Hunter, Cleghorn, and Guattani under the name of *Aneuresmal Varix*. This pathological state may also be complicated with a circumscribed aneurism : that is to say.

after the aneurisinal varix has existed for a greater or less length of time, it may happen that the two vascular parietes separate by the relaxation of the cellular tissue which unites them, and a sanguineous tumor forms between them, without interrupting the course of the fluid from one vessel into the other. This disposition which has been noticed by Messrs. Parek, Physic, etc., constitutes what English pathologists call *Varicose Aneurism*.

In the last two species of Aneurism, anatomy demonstrates, and observation has proved, that a cure cannot be accomplished with certainty unless a ligature is placed above and below the disease. In fact, on the one hand, the collateral arteries are, generally, in such cases, greatly enlarged; the functions of the vein being changed, its parietes have assumed the most of the characters peculiar to the arteries; the latter, on the contrary, performing in part the functions of the venous system, have become weaker. It also follows that after the application of a simple ligature above the lesion, neither the vein nor the artery are obliterated below it, and the disease persists. On the other hand, MM. Richerand, Dupuytren, J. Cloquet, &c. have seen subjects affected with these aneurisms, in whom the operation had been performed according to Anel's method without any advantage; on the contrary, the life of some of them has been seriously compromised, and in others it became necessary to resort to amputation of the limb; finally, in the most fortunate circumstances, a second operation has produced a complete cure. These cases, therefore, demand the old operation.

Above the point which has just been examined, the median basilic vein is separated from the artery, in the first place, by the fibrous bandelet of the biceps, afterwards by the aponeurosis, upon which the vein is applied. Here, embonpoint or emaciation produce but little difference in the relations of the vessels, because the fat always accumulates between the vein and the skin, and not between the vein and the aponeurosis, nor between the latter and the artery. It must nevertheless be admitted, that, in individuals very much emaciated, the cellular laminæ united to the fibrous layer are firmly applied to one another; so that the aponeurotic envelope of the arm is actually agglutinated with the corresponding parietes of the two vessels. In this case we con-

ceive that the only rational method of avoiding the artery consists in introducing the lancet very obliquely, in order to puncture the vein in its anterior half only.

Whenever we draw blood from the median basilic vein, as the humeral artery is bound down upon the tendon of the biceps by the aponeurosis, or by the fibro-cellular tissue which fills the aperture of the latter, we will considerably increase the depth of this vessel by turning the fore-arm in *forced pronation*. Then, in fact, in proportion as the tendon is drawn downwards, the three muscular eminences become more prominent, and consequently render the veins more superficial. The ancient surgeons also recommended this plan when about to open the vein under consideration, with a view of preventing a puncture of the aponeurosis and tendon; but, as it relates to this, it is now proved that the severe symptoms which sometimes follow venesection, must be referred to other causes than the wounding of the fibrous elements of the region. All that we can concede to this idea of the ancients is, that by puncturing the aponeurosis under the vein, we may, in certain cases, determine inflammation of the deep cellular tissue; and as the tumefaction consequent upon it will be repressed by the fibrous expansion, a species of strangulation and more or less formidable phenomena would result from it.

Those symptoms which are referred to pricking the aponeurosis, tendon or nerves, almost universally arise from phlebitis, or from the formation of vast phlegmonous abscesses under the skin. Phlebitis was unknown to the ancients; but it seems to us that many moderns have caused it to perform too extensive a part in the inflammations which follow bleeding from the arm, and we think that they have too frequently attributed to it the simple or phlegmonous erysipelas produced by this operation. During the present year, we have seen at the Hospital of the Faculté, six patients in whom, after a puncture with the lancet, pain, redness, and tumefaction at the fold of the arm took place: these symptoms extended rapidly throughout the entire limb, and fever was excited; four of these patients recovered, after the formation of more or less extensive abscesses; the other two died, and in these the skin was detached, by the disorganization of the subcutaneous adipo-cellular layer, from the hand to the shoulder. In the

midst of this disorganization the veins were healthy, and their calibre had undergone no alteration.

A fact of this kind was recently observed by M. Ch. Delange, in a soldier who died at the Hospital Val-de-grace. The pus had spread throughout the whole length of the limb, even into the thorax; yet, notwithstanding, the internal coat of the vessel presented no decided inflammatory character. M. Broussais himself, who assisted at the autopsic examination, could not detect any.

The *Median Cephalic* is generally a little larger than that which has just been examined. As it ascends outwards, included in the radio-bicipital-furrow, it is accompanied by the internal branch of the musculo-cutaneous nerve. This nerve, which is always of a certain volume, sometimes passes before, much more frequently behind the vein, which on its part crosses the radial artery near its origin. Its distance from the humeral artery is greater in proportion as it approximates the trunk of the cephalic, and it is never so near this artery, unless by anomaly, as to endanger a wound of the latter in drawing blood from the external median; but it should be observed, that in cases wherein the radial artery comes from the brachial region, this vein is generally contiguous to it. The median cephalic is usually less directly applied upon the aponeurosis than the basilic; the groove in which it is imbedded being broader, and the cellular tissue more abundant, it follows that it generally appears deeper, and rolls less under the finger; the tissues upon which it rests being less solid, less resistant, it sometimes happens that after having opened it, the flow of blood is with some difficulty restrained, because the pressure is not made so exactly upon it as upon the internal median. Every one knows also that occasionally, when we wish to stop the bleeding from one of these veins, the blood continues to flow, notwithstanding we apply the thumb below the puncture. This peculiarity, with regard to both, arises from our pressing upon the middle median vein below its division, and from the blood returning by the deep median; or, with respect to the median cephalic in particular, from the aponeurosis behind it not affording sufficient resistance to admit of the obliteration of this canal by the pressure of the finger.

The *Trunk of the Median* runs parallel to the internal margin of the supinator longus; so that it is only separated from the radial artery by the aponeurosis, and, more frequently, by the border of this muscle. Therefore, when we wish to lay bare the artery, we are obliged to push the vein towards the ulnar side of the region. The latter is often surrounded by several nervous filaments from the musculo-cutaneous, and the internal branch of this nerve almost always runs along its outer side; for which reason, phlebotomy, although easy here, might give rise to serious symptoms.

From all these considerations we draw the following conclusions: 1st. That venesection is more easy from the internal median, but also more hazardous than from the external; 2d. that this operation may be performed upon all the veins of the fold of the arm; 3d. that, if in thin persons these vessels are large and distinct, they also roll more easily under the skin, on account of the mobility of the cellular tissue; 4th. that if, in very fat subjects, it is sometimes very difficult to see and feel them, they are, by way of compensation, fixed, scarcely moveable, and more remote from the organs which should be avoided: hence, in eastern nations, Turkey for example, those empirics who make bleeding their trade, plunge their enormous lancets without hesitation, an inch deep into the plump arms of these indolent people, especially of the females, almost all of whom possess considerable embonpoint; 5th. that the *flammette*, used by German surgeons, applied upon the median basilic would be dangerous, on account of the vicinity of the artery; and, upon the median cephalic, would often fail to open the vein, on account of the suppleness of the tissues in which it is imbedded; 6th. that the *thrombus* must supervene more frequently in thin individuals than in those of an opposite condition, in consequence of the facility with which the parts slide over one another, thereby destroying the parallelism of the opening. This accident is most liable to occur when, for the purpose of removing the artery, the fore-arm is placed in a state of forced pronation during the puncture, because then, if we do not afterwards retain the arm in the same position whilst the blood is flowing, the aperture in the skin will no longer correspond with that of the vein, and the blood will become extravasated into the cellular tissue.

We find as many deep-seated veins as arterial branches ; sometimes more. The radial is frequently double ; the ulnar sometimes presents the same disposition, as well as the humeral. At the place where the two former unite in order to form the latter, they receive the communicating branch of the median, so that in this situation there is a species of confluence. When there is only one vein for each artery the radial is placed on the inner, the ulnar on the outer side ; the humeral also is most frequently external, sometimes anterior and even internal. As to the smaller branches, their course is similar to that of the arteries.

vii. *The Lymphatics.*

These vessels consist of two sets, a superficial and deep-seated ; the former is most abundant, and both accompany the blood-vessels, the veins in particular. They are so large, especially in the internal furrow, that if divided in venesection they will give forth considerable lymph. When pus, or other pathological products, exist in the tissues through which they pass, they readily become engorged and inflamed. Also, after bleeding, they often seem to us to be the point at which erysipelatous inflammations, so frequently consequent upon this operation, originate. We even think that what is sometimes referred to inflammation of the veins not unfrequently appertains to the lymphatics alone.

The Lymphatic Glands are situated in the internal bicipital groove, before and above the trochlea, and are generally three, four, and even five in number. These bodies are situated between the deep-seated cellular and aponeurotic layers. They sometimes become engorged and considerably enlarged from suppurations of the hand and fore arm, in consequence of inflammations, blisters, or any morbid affection whatsoever.

viii. *The Nerves.*

These are also superficial and deep seated.

Among the former, we find, first, the *musculo-cutaneous* : this cord is the largest ; it comes from under the aponeurosis upon the external side of the biceps, about one inch above the articulation. A little lower down it divides, and its branches generally

follow the veins which unite to form the cephalic trunk. We have already said that the largest of these branches is situated upon the radial side of the common median.

Next, the *Internal Cutaneous*, which is situated in the ulnar furrow. Its twigs are smaller than those of the preceding, and are distributed around the branches which go to empty into the basilic and median veins. The filaments of the latter nerve are almost always before the veins, whilst those of the musculo-cutaneous are generally situated behind it.

The second set also comprises two nerves. In the first place we meet with the *radial*; this nerve coming from the posterior part of the arm, places itself between the brachialis internus and supinator longus, then between the biceps and extensor radialis longior, and at length divides opposite to the articulation. Thus far it has continued in the bottom of the radial furrow, separated from the humeral artery by the entire thickness of the brachialis internus and biceps muscles, and sufficiently distant from any vein to be out of danger in bleeding. Its posterior branch turns outwards, passes between the extensor radialis brevis and supinator brevis, traverses the fibres of the latter and penetrates into the posterior region of the elbow. As this branch lies very near the head of the radius, and turns over it, it may be stretched, compressed, etc. in luxations of the humeral extremity of this bone forwards. The radial nerve, properly so called, is constituted by the anterior branch. Its direction seems to be a continuation of that of the trunk; it rises a little, in order to descend parallel to the length of the limb behind the great supinator, and is soon found by the side of the radial artery. Hence it follows that the anterior branch of the radial nerve is the more remote from the artery the nearer it approximates its origin, and that these organs are separated by a triangular space with superior base, in which we see the tendon of the biceps and a part of that of the brachialis internus muscle.

Next the *Median Nerve*. It enters this region without any diminution of its volume. It is almost constantly situated upon the ulnar side of the artery, and rests upon the fore part of the brachialis internus muscle; it descends into the hollow of the elbow along the inner portion of the bicipital tendon and covered by the radial side of the internal muscular mass, always pre-

serving its relations with the artery, to which it is then very closely approximated. In passing through the pronator teres muscle in order to place itself before the flexor profundus, this nerve is found behind the radial artery, or rather between it and the ulnar; so that the latter removes from it considerably in passing towards the flexor carpi ulnaris muscle. It is when running under the muscular eminence that the median gives off many filaments, and it is previous to its exit from the region that it furnishes the interosseous, and the various twigs which sometimes follow the ulnar artery. According to this disposition it would be difficult for this large nervous cord to be injured in luxations of the elbow, but it may be struck with the point of the lancet when we open the basilic vein. In the operation for aneurism, it may embarrass the surgeon, and be taken for the artery, when the pathological state of the tissues no longer permits us to distinguish its characters readily. It should not, however, be comprised in the ligature, for paralysis of the first four fingers would necessarily follow, if the limb does not fall into gangrene.

IX. *The Skeleton.*

It comprises the anterior portion of the articulation, of the inferior fifth of the humerus, and of the superior fourth of the ulna and radius.

The joint here presents three grooves and four eminences, covered by a fibrous lamina of greater or less thickness. In order to distinguish these objects, the limb must be extended. The median groove is that in which the coronoid process of the ulna rolls; it is covered by the brachialis internus, corresponds to the humeral artery and median nerve, and it is in this point that the ligament of the articulation is the strongest. The second groove exists between the condyle and the internal tuberosity; it is not articular, and is covered by the origin of the ulnar muscular mass. The third, or external, rolls upon the superior extremity of the radius; it is particularly concealed by an almost isolated bundle of the brachialis internus muscle.

Of the four eminences, the external, formed by the condyle or small head of the humerus, surmounted by the epicondyle, is the most developed: it is concealed by the external muscular

mass. That which comes next represents a species of crest, which rolls upon the ulna, and even upon the radius also. The third, very large, is the trochlea, and the fourth, which is inclined considerably backwards, is the *epitrochlea*. Above these different points, the humerus presents a species of transverse furrow, which is produced by the anterior surface of the articular pulley being raised forwards. It is upon this furrow that the knife frequently strikes, when carried too high in disarticulating the fore-arm according to the method of M. Dupuytren; but this mistake will always be avoided, if we take the precaution to draw the instrument from one humeral tuberosity to the other, keeping it upon a line a little distance below them. In this furrow, two fossettes are observed: one, small and of slight depth, above the external humeral groove, receives the fore-part of the head of the radius in the forced flexion of the fore-arm; the other, very deep and broad, receives the coronoid process of the ulna, in the same movement, above the median articular groove. Still higher, the anterior aspect of the humerus is flattened, and entirely covered by the brachialis internus muscle.

Below the articulation, the ulna presents in the first place, the coronoid process which may be more or less curved upon the os brachii, and thereby powerfully oppose its luxation. In all cases in which amputation of the fore-arm at the joint is required, this curvature should be recollected; for it would be in vain to attempt introducing the knife between the osseous surfaces until this process is depressed. Its anterior surface inclines downwards and forms another curve with an inferior concavity, below which the brachialis internus is inserted, and where the trochlea of the humerus lodges when luxated forwards. It is at this point, and especially in the radial and olecranoid excavations of the humerus, that those small clusters of synovial tissue exist, which, when attacked with chronic or acute inflammation, frequently form a focus whence white swellings and other serious diseases of the joint radiate.

The Radius presents, in this region, its head, enveloped by the annular ligament, the supinator brevis, and all the muscles of the epicondyle;—its neck, the bicipital tubercle, and the commencement of the body of the bone: it is upon the neck that the humeral condyle rests when displaced forwards. Above the bicipi-

tal tubercle, between the radius and ulna, there is a space, through which an instrument may be passed, from before backwards, without fracturing the bones. From what has just been said we perceive that, if the humerus can easily slip upon the anterior surface of the fore-arm, it would be very difficult for it to pass outwards or inwards, unless the ligaments, muscles, and even the vessels are at the same time lacerated. On the other hand, the inequality of all these surfaces, and their extensive transverse dimensions, render the articulation very solid, and only admit of the motions of flexion and extension, always joining to them the rotatory movement of the radius.

Recapitulation. In the anterior region of the elbow we observe the following order of super-position;—1st, the skin; 2d, the fascia superficialis, or the subcutaneous layer, varying considerably in thickness, and including the superficial veins, nerves, and lymphatic vessels; 3d, the aponeurosis, thicker upon the external and internal eminences and furrows, thinner, and actually perforated by a large aperture in the median excavation: 4th, the arteries, muscles, deep-seated nerves, veins, and lymphatics: 5th, and lastly, the articulation and the bones. But we have observed that these different layers are very variable in thickness in the different points at which they may be examined.

Sect. 2. Posterior Region of the Elbow, or the Elbow, properly so called.

The surface of the elbow presents three very distinct osseous projections which are;—externally, the *epicondyle*; internally, the *epitrochlea*, and in the middle the olecranon, which is, however, a little nearer to the internal than the external tuberosity. When the limb is extended these eminences are situated nearly upon the same line, but then the olecranon is scarcely prominent; when flexed, they represent a triangle, the apex of which is inferior; and the olecranon, which then seems to be very much elongated, is below the articulation. The middle prominence is prolonged upwards, under the form of a flattened cord, which is produced by the tendon of the triceps; and downwards by means of the ulna. In whatsoever position the limb is placed, the internal eminence is equally prolonged superiorly by the

epitrochlo-humeral (inner intermuscular) *ligament*, and inferiorly, by the extensor carpi ulnaris muscle. As the external ascends it becomes less distinctly marked by the outer border of the humerus; immediately below it we may distinguish a transverse groove, which corresponds to the humero-radial articulation, then the head of the radius, which may easily be felt rotating in its annular ligament.

These three projections are separated by two grooves, of which the internal, which is deepest, passes between the olecranon and epitrochlea. This species of gutter insensibly contracts above the joint, by the gradual approximation of the internal portion of the triceps and of the *epitrochlo-humeral intersection*. It is in this groove that we find the ulnar nerve. The external separates the epicondyle from the olecranon; it is more superficial and irregular than the preceding; in ascending, it is almost immediately lost behind the tendon of the triceps. A knowledge of these features is of importance, especially when we wish to establish the diagnosis of fractures and luxations of this region.

CONSTITUENT PARTS.

I. *The Skin.*

It is thicker and much less extensible than at the fold of the arm; its surface is uneven, rugous, even plicated in arcs of circles in some subjects, above the olecranon; it includes numerous sebaceous follicles and an abundance of hairs, in some male adults. To the latter, the median line must at all times form an exception, as it is always bare.

II. *The Subcutaneous Layer.*

This layer is composed of a lamellated cellular tissue, which is very lax behind the triceps, but much more compact upon the osseous eminences. Below the articulation this layer generally incloses the terminations of the posterior radial and posterior ulnar veins; some branches of the musculo-cutaneous, of the internal cutaneous and even of the radial nerves, also ramify in it. Adipose vesicles are more numerous in it the further we remove

from the articular eminences ; so that the fatty tissue may form a layer of a certain thickness in the lower part of the region, and another still thicker in the superior part, whilst behind the elbow properly so called, fat very seldom accumulates. Upon the olecranon, the lamellæ of the cellular tissue are so much condensed that they frequently produce a complete *bursa mucosa*, which is susceptible of different degrees of capacity, but in the normal state never contains more than a small quantity of fluid. In certain diseases, on the contrary, it sometimes becomes distended with liquid, producing a tumour of greater or less volume under the skin. It is equally subject to a form of disease which is more frequently observed in the synovial membranes of the wrist ; we mean the production of cartilaginous granules, which may accumulate in this sac to the number of several hundreds. It may be remarked that although these tumours are very dangerous at the wrist, they may be easily cured at the elbow ; at least we saw, in 1824, at the Hospital of *la Faculté*, a patient who had one on each olecranon process, and was promptly relieved of them. M. Bougon opened them extensively ; all the small productions were removed, the cyst inflamed, suppuration followed, and the cicatrization was completed at the end of a month without any accident. As this tissue is very moveable, the divisions of the skin may be easily united by the first intention. Even in wounds with loss of substance, the lips of the solution are easily approximated, and the cicatrix is seldom very extensive. In consequence of this laxity also, when phlegmonous erysipelas or other inflammations supervene, the sub-cutaneous layer is disorganized with a great promptitude and the skin rapidly and extensively detached.

III. *The Aponeurosis.*

Behind the tendon of the triceps, the aponeurosis, as it approximates the olecranon, becomes considerably attenuated ; it is transformed, as it were, into cellular tissue, so that upon the median eminence it is no longer met with. On the inner side it passes to the *epitrochlo-humeral intersection*, but, previous to reaching it, splits in order to ensheath the ulnar nerve. In this direction, it also becomes thinner as it descends and again grows

thicker opposite to the olecranon, from whence it detaches a species of cord which goes upon the *epitrochlea*; still lower, this fibrous lamina arises from the posterior ridge of the ulna, in order to pass internally upon the extensor carpi ulnaris muscle. On the outer side, it also arises from the triceps tendon at the *epicondylulo-humeral intersection*, unfolding in such a manner that one of its laminae passes to the border of the bone, and that between the two there is a considerable branch derived from the radial nerve. Between the olecranon and the epicondyle, the fibres which come from the triceps intersect those which proceed from the ulna, in order to pass on the outer side of the fore-arm. Finally the aponeurosis is of much less importance, in surgical practice, in this region, than in the preceding.

IV. *The Muscles.*

Above the prominences the triceps exists alone; its fibres cease in the internal groove; its external bundle, on the contrary, is prolonged to the posterior part of the humero-radial articulation, where it is continuous with the anconeus; its tendon is inserted upon the olecranon in such a manner that, in the flexion of the fore-arm, it draws this process at a right angle, whilst, in extension, it tends to draw it parallel to its length: whence it follows that flexion of the limb backwards would not be possible, even if the olecranon should not strike against the humerus. It should be observed, however, that the tendon is not inserted into the superior surface of this process, but into its posterior part. The kind of cord which seems to attach the olecranon to the humerus during flexion of the fore-arm, is produced by the tension of this tendon. A few fibres are occasionally detached from the triceps to be inserted into the fibrous layer which covers the olecranoid cavity.

Inferiorly, we find, internally, the flexor ulnaris, the two origins of which, from the olecranon and epitrochlea, are united by a fibrous arch, before which the ulnar nerve passes; externally, the supinator brevis, the origins of the extensor communis, extensor minimi digiti, extensor ulnaris, and the anconæus. These muscles are so disposed that the head of the radius is almost naked under the skin, between them and the external muscu-

lar mass of the fold of the arm ; so that it would seem much more easy for luxation of this bone to take place backwards than forwards. They are, moreover, very adherent to the osseous surfaces, a circumstance which renders their action of little effect in fractures (as it regards displacement).

v. *The Arteries.*

These vessels form two arches, situated in the two principal grooves : the external is produced by the anastomoses of the posterior radial recurrent, coming from the interosseal, with the termination of the external collateral of the arm. It lies deep between the muscles, behind the epicondyle and the supinator brevis ; it is occasionally of large size, so that a wound in its track might be attended with a profuse hæmorrhage, and render its ligature necessary in the disarticulation of the fore-arm. In fractures of the epicondyle, and in luxations, it might be lacerated and produce extensive ecchymoses.

The internal results from the inosculation of the internal collateral with the posterior ulnar recurrent ; its branches ramify in the inner groove, behind the epitrochlea, and anastomose in their turn with those of the preceding, as well as with the anterior epitrochlear arch. In aneurisms, or when the brachial artery is obliterated in any manner whatsoever, these anastomosing arches sometimes become very large. It is in such cases that a division of the soft parts in the region of the elbow might be accompanied with a troublesome hæmorrhage, and that, if we were obliged to amputate the limb very near the joint, a great number of ligatures would become necessary.

vi. *The Veins.*

The deep veins accompany the arteries and have the same distribution. The superficial vary considerably in number, and still more in disposition. Two of them are usually met with : the posterior radial, which ascends and inclines slightly outwards, in order to pass before the epicondyle and unite with the anterior radial, forming the cephalic trunk, of which these two veins are only branches of origin : the posterior ulnar, which which is

generally larger and more constant, ascends upon the flexor ulnaris muscle as far as the epitrochlea; then it passes sometimes behind, more frequently before this process, in order to unite with the basilic, which it concurs in forming. As these two veins are surrounded by but few nervous filaments, they might serve for the abstraction of blood; but we rarely have recourse to them, because the anterior veins are always more distinct and more easily opened.

VII. *The Lymphatics.*

We find no glands here. The vessels are few in number; the superficial turn over the external and internal borders in their course to the fold of the arm; the deep-seated lymphatics accompany the arterial arches, or pass through the interosseal space, and enter the glands of the anterior region.

VIII. *The Nerves.*

Some filaments, and the posterior branches of the internal cutaneous and musculo-cutaneous nerves, pass or ramify in the superficial layers; one branch of the radial descends behind the *epicondylar-humeral intersection* (external intermuscular ligament), and follows the course of the *arteria profunda*; this branch is frequently larger than the internal cutaneous, and should be avoided in cases wherein it is required to tie the artery. The posterior branch of the radial also gives off several ascending ramuscles below the articulation, and ramifies principally in the superficial muscles; but the ulnar is the principal nerve here. It lies upon the *epitrochlear-humeral intersection* (internal intermuscular ligament) between the aponeurotic laminæ, it descends in the internal groove, and, behind the epitrochlea, is covered only by the skin and the aponeurosis, so that it may be felt through the integuments and may be easily compressed at this point by the action of external agents, as, for example, when we strike the elbow against the angle of a table, etc. It is this compression which gives rise to the sudden numbness, or species of formication, which we then feel in the last two fingers. As it passes before the flexor ulnaris muscle it gives off some unimportant

filaments and soon places itself between the two common flexor muscles of the fingers. In the *resection* of the inferior humeral extremity, the ulnar nerve requires some precautions: in fact it would be very easy to divide it entirely or incompletely, by making the flap required for exposing the bone at the expense of the triceps. It is important, however, to preserve it, if we do not wish to paralyze the last two fingers. It will therefore be necessary to separate this nerve from the groove in which it is imbedded, and draw it before the epitrochlea previous to making use of the saw.

IX. *The Skeleton.*

The humerus presents in this region the posterior part of the osseous grooves and projections mentioned in the preceding region. Above the articular pulley we observe a deep cavity, into which the synovial membrane is prolonged, and which receives the olecranon when the fore-arm is extended. It appears to be owing to the greater or less depth of this cavity that some persons possess the power of carrying the fore-arm backwards beyond the axis of the limb. Its bottom is occasionally very thin; it corresponds to the coronoidal depression, and is sometimes completely perforated. Be this as it may, it is necessary to remark that, when the arm is flexed, this hollow is covered only by the soft parts, the triceps and the fibrous membrane, which naturally conceal it: whence it follows, that, in this position, a pointed instrument might pass through it from behind forwards and wound important organs, the brachial artery, the median nerve, for example. The rest of the humerus is smooth and slightly convex; it is separated from the triceps by a very supple cellular tissue, which readily inflames when acute diseases attack the articulation. If the bone was transversely fractured here, the inferior fragment would be thrown backwards, in consequence of the brachialis internus muscle drawing the superior end forwards. Oblique fractures easily extend into the joint, and may be of two species: either the solution of continuity will be made from without inwards, and then the external condyle and the tuberosity which surmounts it will constitute the inferior or external fragment; or it may take place from within outwards.

so as to comprise the trochlea and epitrochlea in the internal fragment. In the first case, the posterior muscles of the fore-arm will tend to draw the condyle downwards and backwards; in the second, the trochlea will be drawn downwards and forwards by those of the anterior part.

The ulna (*cubitus*) is covered internally by the flexor carpi ulnaris muscle, and by the anconæus, externally; its posterior border is covered merely by the skin, and is connected to the humerus by the internal lateral ligament, which bifurcates as it proceeds from the epitrochlea, in order to attach itself to the olecranon and the coronoid process. The olecranon process is one of the most essential parts of the elbow; as it is carried backwards in the flexion of the limb, which then becomes a lever of the first order, it elongates the arm of power, by separating the triceps from the fulcrum; but in this position, an instrument thrust behind the elbow might be attended with great danger, because it would readily penetrate into the joint. In extension, this eminence will not permit a wound of this nature, but will prevent any species of weapon from traversing the humerus by the olecranon cavity; besides, it will also oppose an insurmountable obstacle to the luxation of the fore-arm forwards, whilst, in the first case, it does not appear impossible for an external cause to produce this displacement; finally, it is the olecranon which constitutes the greatest impediment to the disarticulation of the fore-arm. Indeed, in this operation, a large flap being made at the expense of the anterior soft parts, the fore-part of the joint being opened by the division of the internal, external and anterior ligaments, the olecranon remains, and forms an obstacle to the separation of the limb. Hence, we are obliged to saw through this process, which the triceps will not fail to draw considerably upwards; or it may be removed by sliding the knife between it and the os brachii, in order to detach it from the extensor muscle; but as the muscle, in this case, retracts greatly, the skin alone will remain to form the posterior flap. We would therefore prefer the first method, if ever this operation should be absolutely necessary, which, however, is very questionable.

The *Radius* affords nothing very remarkable in this region: externally, it is so superficial that it is easy to recognize its frac-

tures, and the supinator brevis envelopes it almost entirely. It is more easily luxated backwards than in any other direction: on the one hand, because the articulation is less firmly supported at its posterior part; on the other, because the movement of pronation is more natural than that of supination, and because, when this motion is forced, the radius tends to tilt upon the ulna and pass behind the humerus. It is for this reason that this displacement is not rare among washer-women and those who are much occupied in wringing linen.

The order of superposition in the posterior region of the elbow seems to us too simple to require pointing out.

We may now easily comprehend the obstacles which oppose the *resection* of the bones of the elbow; as this operation has been performed, however, first by Mr. Park of Liverpool, afterwards by the two Moreaus of Bar-sur-Ornain, and Prof. Roux, and several times with success; as, by this operation, the forearm and the functions of the hand are preserved, the difficulty of executing it should not prevent its being had recourse to. According to the method of the MM. Moreau, the inferior extremity of the humerus may be removed without difficulty. It consists in making two incisions, one on each side of the bone, and uniting them by a third drawn transversely above the olecranon; it will then be necessary to preserve the ulnar nerve, by dissecting it from its sheath and carrying it before the epitrochlea, as advised by M. Dupuytren, previous to separating, by means of a suitable instrument, the flesh from the anterior part of the articulation and sawing through the osseous extremity. It is evident that, in this way, the artery and nerves remaining untouched, the accidents which must follow will be analogous to those which usually accompany extensive wounds; but if the disease required, at the same time, the *resection* of the ulna and radius, the anatomical disposition of the organs induces us to believe, that, by removing these bones below the insertion of the brachialis internus and biceps muscles, the chances of success from the operation would be greatly lessened, and the flexion of the fore-arm would be rendered impracticable.

ART. IV. OF THE FORE-ARM.

The fore-arm, properly so called, is comprised between the regions of the elbow and a circular line drawn half an inch above the radio-carpal articulation. Its form is that of an inverted cone, truncated and flattened upon two faces, especially inferiorly. This form varies according to age, embonpoint and the position of the limb; in children and fat persons the cone is more regular; in emaciated persons, on the contrary, the fore-arm is very much flattened, and nearly as broad inferiorly as at its superior part; in flexion and pronation, its anterior surface is more convex than in extension and supination.

In the latter position, the fore-arm presents for our consideration a palmar and a dorsal aspect, a radial and an ulnar margin.

Sect. 1. Anterior, or Palmar Region.

When the limb is in the state of pronation, the inferior part of this region is directed backwards, its superior portion inwards: on its surface we observe, superiorly, the continuation of the two muscular eminences of the fold of the arm, and the median groove which separates them; in the middle, these two eminences are almost confounded, and the groove is scarcely perceptible; in approximating the wrist, we see, or may feel, from within outwards, the prominence formed by the flexor carpi ulnaris, a groove in which the ulnar artery may be felt, another prominence formed by the flexor muscles of the fingers, a third by the tendons of the palmaris longus and flexor carpi radialis, and which is much increased by the flexion of the wrist upon the fore-arm, the fingers being extended; a groove broader and more distinct than the first, which groove may be considered as the termination of that of the superior part, and in which we distinguish the radial artery through the integuments; finally, a fourth prominence, which is observed on the outer part and is constituted by the radius. A considerable number of veins also raise the skin, and form a more or less complicated plexus throughout the whole extent of this region.

CONSTITUENT PARTS.

I. *The Skin.*

It participates in all the characters of that of the fold of the arm : thus, it is soft, white, extensible, sometimes covered with hairs, but on the outer and inner borders only, and contains a small number of sebaceous follicles upon the median line.

II. *The Subcutaneous Layer.*

The same observations may be applied to it as to the skin ; in man it includes but a small number of adipose cells, and the lamellated tissue which composes it forms a layer of greater or less thickness, and always very moveable, which admits of the skin being readily drawn up without dissection, when we amputate in this part of the fore-arm, etc. In childhood and in the female, an abundance of adipose vesicles is sometimes developed in it ; it is then of greater thickness, and it is this adipo-cellular layer which gives to the fore-arm that cylindrical form which is peculiar to the female sex. As this tissue incloses the veins, these vessels are always more distinct in man than in woman. It is this layer also which is the seat of the principal disorders in phlegmonous erysipelas ; and as it is not firmly adherent either to the aponeurosis or skin, it is necessary to evacuate promptly the diseased fluids which may have accumulated in its lamellæ, if we wish to avoid the detachment of the cutaneous envelope.

III. *The Aponeurosis.*

If we commence with this membrane at the posterior border of the ulna and trace it to the anterior margin of the radius, we will find that it has not exactly the same arrangement throughout the whole extent of the region. In departing from the bone, superiorly, it passes over the anterior face of the flexor carpi ulnaris muscle ; between this bundle and the flexor sublimis, the aponeurosis sends off a sheet which passes inwards before the flexor profundus and from thence to the ulna, completing the

sheath of the flexor ulnaris muscle : the place at which this sheet is detached is always marked by a distinct line, which directs us in finding the ulnar artery. The aponeurosis is afterwards continued over the anterior surface of the muscles ; when it gets near the supinator longus it splits, and its superficial lamina passes before this muscle, whilst the deep-seated passes behind it and forms, on its part, a small sheath for the radial artery : beyond the supinator, these two laminæ approximate and become blended with the aponeurosis of the posterior region. Inferiorly, the two sheets which envelope the flexor ulnaris, become conjoined before they attach themselves to the ulna ; and the same takes place with respect to those of the supinator longus previous to their insertion into the radius ; so that between these two muscles, the aponeurosis binds down all the other tendinous and muscular organs, and no longer forms but a single lamina. It must be observed also that a third very thin sheet passes from the anterior margin of the ulna before the flexor profundus, and that it is upon this that the ulnar artery lies ; so that, in order to expose this vessel, two fibrous laminæ must be divided ; whereas, but one only is met with before the radial.

The most of the fibres of the anti-brachial aponeurosis are transversal ; superiorly, they give attachment to the fleshy fibres ; inferiorly, the expansion which they form has no adhesion with the muscles.

iv. *The Muscles.*

They are numerous and form two strata : the first, taken in the direction from within outwards, comprises the flexor carpi ulnaris, flexor minimi digiti, flexor sublimis, palmaris longus, flexor carpi radialis, and pronator teres ; the second, the flexor profundus, flexor longus pollicis, and pronator quadratus ; finally, upon the fore part of the radius we observe, superiorly, the termination of the pronator teres and of the supinator brevis, the extensor radialis longior and brevior, and the supinator longus. It is between these two layers that the principal nerves and vessels are situated. The flexor carpi ulnaris and sublimis separate as they descend, and give rise to the internal gutter : the ulnar artery corresponds to this interval ; the supinator longus and the flexor carpi radialis also separate, in order to form the external

gutter which includes the radial artery. The *extensores radialis longior et brevior* turn outwards and pass into the posterior region. The origin of the *flexor profundus* is prolonged as far as just below the coronoid process, and is also attached to the radius below the bicipital tubercle: it is above the species of arch which it forms superiorly, that the interosseous artery insinuates itself before the interosseous ligament; the *flexor longus pollicis* rests upon the fore part of the radius, and receives a small rounded bundle from the coronoid process; the anterior interosseous artery and nerve lie in the bottom of the interstice which separates these two muscles. The *pronator quadratus*, from its transverse direction, constantly tends to approximate the two inferior fragments of the bones when fractured.

The superior portion of all these organs is entirely fleshy, whilst inferiorly the fibrous element predominates. The tendons of these muscles, at first more or less blended with one another, afterwards separate; but, nevertheless, they are always connected by a species of fibro-cellular or synovial membrane, the arrangement of which is very complicated, and its inflammations extremely dangerous; whence it follows that wounds of the superior part of the fore-arm must be attended with less formidable symptoms than those of its inferior portion.

v. *The Arteries.*

All the arteries of this region are derived from the brachial. The first is the *radial*, which descends parallel to the direction of the radius, covered anteriorly and in its superior half by the internal border of the *supinator longus* and the two laminae of the aponeurosis; in the other half the aponeurosis alone is before the artery, and its two laminae are usually reunited. The radial rests, from above downwards, upon the tendons of the *supinator brevis*, *pronator teres*, then upon the radius: a cellular lamina separates it from these parts and from the *pronator quadratus*, which is more inferiorly. On its outer side we see, first, the *extensores radialis longior et brevior* and the *supinator longus* muscles, afterwards the tendon of the latter only. The radial nerve lies upon this side also, but it is always a line at least distant from this vessel; so that it may be easily avoided when applying a ligature upon the artery. The *flexor longus pollicis*

and flexor carpi radialis run along its internal surface; more immediately, this artery is enveloped by a cellular sheath, which also contains its two venæ comites. From these anatomical relations, it follows that the radial artery becomes more superficial in proportion as it approximates the carpus, and that, in order to find it, we may have recourse to three different methods almost equally certain. Thus, by making an incision in the direction of a line drawn from the middle of the space which separates the condyles of the humerus and terminating on the inner side of the styloid process, we are certain of falling upon the artery; when the radial gutter is distinct, we might make use of it in the same manner: lastly, after the integuments have been divided, we will always find it between the flexor carpi radialis and supinator longus. By attempting to discover it according to these methods, the skin being divided, the median vein will frequently present itself in the direction of the wound; it should be pushed inwards, and we will always avoid mistaking it for the artery, if we recollect that the aponeurosis separates these two vessels; a grooved director is then to be insinuated under this fascia, upon which the bistoury is to be introduced for the purpose of incising it, when, if we operate inferiorly, the artery will be exposed; if higher up, the margin of the supinator must be pressed outwards, when we will see the artery, surrounded by its venæ comites, through a second fibrous lamina which should be divided also, in order that the aneurismal needle may be passed behind it, which, as there is no essential organ in its immediate vicinity, may be introduced on either side. The nerve is sufficiently remote on its outer side to be always avoided.

The radial artery is sometimes subcutaneous, and this anomaly might render very superficial wounds dangerous. In such a case, its pulsations are usually perceived through the skin; but if the limb is engorged or tumefied, in any manner whatsoever, and an incision is required to be made upon it in the course which this artery then takes, we can conceive the accidents which might result from it. At other times it changes its direction, and about the middle of the fore-arm turns over the outer side of the radius. This anatomical variety is one of the most frequent, and requires special notice, for it might lead to a deception with respect to the nature of the pulse in diseases, if, as frequently happens, a branch of a certain calibre supplied the place of the trunk: it

might also cause a profuse hæmorrhage in a simple wound of the external part of the fore-arm. The first disposition generally depends upon the high division of the brachial artery; and the second, upon the small dorsal branch of the radial having acquired a greater volume than usual.

The *Ulnar* comes next, forming as it descends a gentle but very long curvature, with external convexity. It is at first situated between the superficial muscular stratum and the flexor profundus, and in the anti-brachial region is found in relation with the following organs;—anteriorly and externally, the flexor sublimis; posteriorly, the profundus; internally, the flexor carpi ulnaris, the tendon of which lies more or less over it; inferiorly, more immediately, we see upon its external side its collateral vein or veins: the ulnar nerve touches it upon the internal side. It is, consequently, very deep superiorly, and very difficult of access. If, however, we wish to expose it, we must divide the integuments in the direction of a line which would commence at the inner part of the trochlea in order to descend perpendicularly upon the external side of the os pisiforme; next we would seek for the fibrous line which separates the flexor carpi ulnaris from the flexor sublimis, and which is always the first which is met with in proceeding from the posterior border of the ulna. The aponeurosis being cut through upon this line, the muscles will be easily separated; the nerve will soon be discovered at the bottom of the wound, upon the flexor profundus, and then, by placing the extremity of the needle upon the external side of this nerve, it will be sufficient to dip this instrument a little and afterwards raise it outwards, in order to seize the artery, which is, in fact, almost always placed in the latter direction, and a little forwards; but it is necessary to observe that these relations exist only in the four inferior fifths of the fore-arm; for in the superior fifth, as the artery runs obliquely outwards and upwards, it becomes more and more remote from the ulnar nerve. Inferiorly, after having divided the skin and cellular layer, we must cut the first lamina of the aponeurosis upon the internal margin of the tendon of the flexor carpi ulnaris muscle; then by pushing this tendon inwards we will see the artery through a second fibrous lamina, in general of considerable strength, which binds it down upon the inner part of the flexor profundus; its relations are, otherwise, the same as in the rest of its extent.

This artery is sometimes superficial, so that its pulsations are visible through the skin. In other cases, it does not approximate the nerve until very near its inferior part; it would then be difficult to apply a ligature around it.

Finally, the *Interosseal* divides at the point of union of the flexor profundus and flexor longus pollicis, and the interosseal branch, properly so called, rests upon the anterior surface of the interosseous ligament, which it passes through at the upper part of the pronator quadratus. It is for the purpose of seizing this branch the more readily that, in amputating the fore-arm, we are advised to cut through the ligament which supports it.

From what has preceded, we see that the ulnar artery is not susceptible of being firmly compressed, whilst the radial, on the contrary, may be obliterated by pressing it against the radius, in its inferior half. All the other branches are too small to deserve any attention in operations.

VI. *The Veins.*

The superficial veins form a very complicated net-work under the skin; they communicate with each other a great number of times, and vary greatly both in number and disposition. The most constant and largest are the vena ulnaris anterior, the mediana, and radialis cutanea anterior. The first receives the most of the veins of the hypothenar eminence,* and ascends along the ulnar side of the region in order to constitute, upon the internal muscular mass of the fold of the arm, one of the roots of the basilic. It is sometimes so large that blood may be drawn from it, when this operation cannot be performed elsewhere. It is accompanied by the anterior twigs of the internal cutaneous nerve.

The second arises principally in the palm of the hand; in ascending it follows the radial groove, and in this manner gradually inclines towards the median line of the limb, until it reaches

* The os metacarpi pollicis is surrounded by a considerable muscular mass consisting of four muscles, the abductor brevis pollicis, opponens pollicis, flexor brevis pollicis, and abductor pollicis, these constitute the *thenar eminence*: the *hypothenar eminence* is formed by the muscles surrounding the os metacarpi minimi digiti.—*Transl.*

the anterior region of the elbow, where we have already examined it: this is usually the most voluminous of the three, and therefore that which may be opened most readily, if we cannot perform venesection in the ordinary situation. It must then be kept in mind, that this vein is accompanied by a considerable branch of the musculo-cutaneous nerve, which generally lies upon the external side of the vessel.

The third is one of the principal roots of the cephalic; it comes from the *thenar eminence** and thumb, and does not usually enter the anterior anti-brachial until it arrives near its middle; it places itself externally and upon the anterior face of the external muscular eminence, and afterwards inclines more or less backwards in order to unite with the posterior radial and form the cephalic. This is the most variable, and that which is most frequently wanting; it is only surrounded by some very delicate filaments of the musculo-cutaneous nerve.

All these veins, like those of the fold of the arm, are here enveloped in the deep plates of the superficial layer, and, in this respect, we may apply to them the same surgical considerations. The median generally follows the track of the radial artery; whereby, when we attempt to tie the latter, we are frequently embarrassed by the vein, which must be pushed outwards or inwards, as may be most convenient. The ulnar does not follow the artery of the same name so exactly; so that, when we wish to expose the latter vessel, we are seldom obliged to separate the vein.

They are scarcely distinct in women and children, on account of the thickness of the adipose layer; but in the adult male, old people, and especially those who exercise the hands and thoracic limbs vigorously, their calibre is generally much greater; which is undoubtedly owing to the profuse supply of blood attracted to these extremities by the muscular action, which not being able to ascend in the same quantity by the deep-seated veins is obliged to pass into the superficial.

The deep-seated veins are disposed like the arteries, and are occasionally double. The two radials are situated on each side of the artery and communicate with each other before it, at certain intervals. We less frequently meet with a duplicate of the ulnar and interosseal veins. All these veins should be cautiously

* See Note, page 313.

avoided when we tie one of the accompanying arteries; not from fear of impeding the circulation, but because experience has proved that they readily inflame when comprised in a ligature, and every body knows that inflammation of the veins is dangerous.

VII. *The Lymphatics.*

The superficial are very large and numerous; they wind around the principal veins, and throughout the whole extent of the celulo-adipose layer. The deep-seated form two remarkable clusters around the radial and ulnar vessels, and a third, less constant, or less distinct, which accompanies the interosseous artery.

Generally there are no glands in the anterior region of the fore-arm; however, we have met with one, two, and even three in the track of the radial artery, but they were always very small, lenticular, or hordiforme. We may admit that these organs, in consequence of some morbid virus, are susceptible of acquiring a certain volume, and of producing tumours the nature of which might easily be misunderstood. Finally, the abundance of the lymphatics upon the palmar aspect of the fore-arm, added to the delicate structure of the integuments, is the principal anatomical reason for preferring the application of medicaments upon it which we intend to administer by absorption.

VIII. *The Nerves.*

In speaking of the veins we pointed out the superficial nerves: they appertain to the internal cutaneous and musculo-cutaneous, the anterior branches of which are almost entirely lost in this region, after having ramified a great many times in the cellular layer. Their filaments ultimately terminate in the skin.

The deep-seated nerves appertain to the radial, ulnar and median.

The first (*radial*) follows the external side of the artery, but leaves it inferiorly, turning outwards in order to pass between the radius and the tendon of the supinator longus; so that this nerve runs no risk of being included in the ligature of the radial artery at the inferior fourth of the fore-arm; whilst above this,

these two organs lie so close to each other that it is better, if not indispensable, to introduce the grooved director under the artery from the radial towards the cubital side: a wound of it would impair more or less the action of the first three fingers.

The second (*ulnar*) follows the direction of the line indicated when speaking of the ulnar artery, and runs along its internal side; it is only about three inches below the epitrochlea that it touches, as it were, this vessel; above this, it is separated from it by a triangle with its base uppermost, the external side of which is represented by an oblique line drawn from the tendon of the biceps to four fingers' breadth below the articulation, and in which we find the internal muscular eminence, a portion of the ulna, etc. Near the wrist, the ulnar nerve sends its posterior branch behind the carpus, and the anterior retains the same relations with the artery as the trunk. From its position, this nerve could not be divided by a cutting instrument drawn across the forearm without the artery being equally wounded; so that in a wound of this nature, the paralysis of the last two fingers would be sufficient to induce us to infer that the ulnar artery is divided.

The third, or *median* nerve, descends perpendicularly between the two flexor muscles of the fingers, and like them is found enveloped, near the carpus, in a very dense and very extensible fibro-cellular membrane; it is situated nearly upon the median line; the only branch which it gives off, inferiorly, is the palmaris cutaneus; this, however, is not constant. The interosseous is also derived from the median: it follows the artery of the same name, is always situated on the outer side of it, and is sometimes so adherent to it that it is difficult to separate them: a circumstance which should not be forgotten in amputations, when we are securing the arteries.

The other nervous filaments of this region are distributed to the muscles, and are of no importance in surgery.

ix. *The Skeleton.*

It is represented by the anterior faces of the ulna, radius and interosseous ligament. This surface forms a concavity, the deepest part of which corresponds to the middle of the forearm: the muscles cover it entirely, with the exception of the anterior and

inferior third of the radius, which is subcutaneous. These bones, however, will be described more particularly in the following region.

Sect. 2. Posterior Anti-Brachial Region.

This region is more regularly convex than the preceding; it is more unequal, and its muscles are more distinctly delineated. The principal features which we observe upon its surface are, from within outwards; 1st, an elongated prominence which corresponds to the ulna and the extensor carpi ulnaris muscle; 2d, a groove, scarcely distinct superiorly, much broader and more apparent inferiorly; 3d, another prominence, formed by the fleshy portion of the extensor digitorum communis; 4th, a second groove which separates, superiorly, the latter eminence from that which is formed by the extensor radial muscles, and which turns before and above the extensor muscles and abductor pollicis longus; 5th and lastly, a third relief which corresponds to the latter muscles.

CONSTITUENT PARTS.

I. *The Skin.*

It is of considerable thickness, is shaded by numerous hairs, and contains many sebaceous follicles. Its surface is irregular, rough in thin subjects, in certain diseases, and upon a sudden impression of cold; it is less vascular than upon the palmar surface, though pretty extensible. Solar spots or freckles are as frequently observed here as upon the rest of the limb, especially in those of a fair complexion.

II. *The Subcutaneous Layer.*

This layer is generally thinner than in the anterior region, and contains a smaller number of adipose vesicles; on the other hand, it has greater suppleness and extensibility, but is less adherent to the strata between which it is placed.

III. *The Aponeurosis.*

It is blended with the anterior portion of the anti-brachial aponeurosis upon the posterior margin of the ulna: opposite to the external border of the extensor carpi ulnaris a process, or species of intersection, is reflected from it to the bone, forming a sheath for this muscle; then it furnishes, in the same manner, another sheath for the tendon of the extensor minimi digiti, afterwards a third to the extensor digitorum communis. Finally, the abductor pollicis longus (*extensor primi internodii pollicis*), and the extensores longus et brevis pollicis (*extensores tertii et secundi internodii pollicis*), are equally enveloped by it, when they turn upon the radius. Above and below these last, the aponeurosis attaches itself to the posterior border of this bone; it receives a lamina which separates the two muscular layers, and is continuous with the sheets which enclose the supinator longus, the radiales (extensores), etc. From this arrangement it follows, that each of the dorsal muscles of the fore-arm is enclosed in a species of fibrous canal inferiorly, and that superiorly, they are only separated by intersections which are in general very solid: this perfectly coincides with their functions, since their fixed point is the same, or nearly so, for all, whilst the moveable extremity of each must act independently under a multiplicity of circumstances. It should also be observed that these septa of the aponeurosis, by being fixed from space to space upon the bones, must give to it greater strength and resistance, and that the muscles, more firmly supported, acquire, in contracting, an energy which they would not have possessed if they had been loosely applied upon the skeleton.

IV. *The Muscles.*

They form two very distinct strata: the superficial comprises, in examining them from the radius towards the ulna, the extensor communis, extensor minimi digiti, extensor carpi ulnaris and the anconæus (*épicondylo-cubital*).

The first (*extensor communis*) lies, superiorly, immediately upon the bones and the interosseous ligament: then upon the deep

muscular layer ; externally and internally, it is confounded with the radial extensors and extensor carpi ulnaris ; directly behind, it is covered by the aponeurosis : as it descends, it divides into two bundles, in one of which we distinguish the origin of the tendons which pass to the indicator and little fingers ; in the other, those which go to the middle and ring fingers ; whence it follows, that, the hand being shut, it is not possible to extend the annular finger completely without the medius, whilst we may very readily extend the indicator or little finger separately. The whole of its tendinous portion is enveloped in a species of fibro-cellular membrane, or synovial bursa, which favours its movements, and in which we sometimes meet with very soft and very large fatty vesicles, similar to those situated within the orbit.

The second (*extensor minimi digiti*) is in fact only a *fascis* given off from the former at a greater or less elevation, and only merits particular mention because it is enveloped in a distinct sheath, which permits it to act independently of the tendons of the extensor communis ; therefore we may easily extend the little finger whilst the others are in a state of flexion.

The third (*extensor carpi ulnaris*) is disposed, inferiorly, in such a manner that its tendon lies very superficial ; whence it is very much exposed to the action of foreign bodies, and is frequently divided by transverse wounds inflicted upon the inner border of the fore-arm.

The fourth (*unconæus*) seems to be only a prolongation of the triceps extensor ; its uses are of but slight importance, and, in a surgical point of view, it presents nothing worthy of much attention.

The deep-seated layer contains, from within outwards, the extensor indicis, the short and long extensors of the thumb, and its long abductor ; the tendons of the radials (extensors) are also partly found in it. All these muscles, imbricated upon one another, pass obliquely outwards and downwards, so that the tendon of the indicator does not actually separate from those of the extensor communis until it reaches the wrist. It is the same with the extensor longus pollicis (*extensor tertii internodii*), which is situated a little more externally ; but the extensor brevis (*extensor secundi internodii*) and abductor longus pollicis (*extensor primi internodii*) make a partial spiral turn, extending from the poste-

rior aspect of the interosseus ligament and radius to the root of the thenar eminence ; from which circumstance these muscles are supinators of the thumb and hand, at the same time that they are extensors and abductors. The aponeurosis furnishes for them a fibrous case, which is stronger and more compact the nearer it approaches the wrist. In this canal, the tendons are applied upon one another, and that of the short extensor is behind. Their surface is smooth and covered with a synovial membrane, which also lines the interior of their sheath, and sometimes they are separated by a thin septum, which divides this sheath into two. This theca, or the organs it encloses, is occasionally the seat of a very singular disease, which we have met with in ten or twelve persons, although it is not generally mentioned in works on surgery. We see occurring, without any known cause, or in consequence of some effort, a swelling, which never becomes very considerable, throughout the whole track of the muscles just mentioned : this swelling is accompanied with heat and pain, which are not usually very great, unless the patient endeavours to move the thumb ; but what is most singular, is that, if we grasp the tumid part with one hand and move the thumb with the other, we feel and hear a very distinct crepitus, so much so that we have known a surgeon, in a similar case, pronounce it to be a fracture and apply a bandage. This affection, in those in whom we have observed it, always disappeared at the end of fifteen days or a month, without any one particular method of treating it seeming to be attended with more benefit than another. Although leeches, cataplasms, spirits of camphor, ammoniated liniments, or other discutients were applied, and compressive bandages or rest had recourse to, it could not be ascertained which of these means actually deserved the preference, and we think that its appropriate remedy is yet to be discovered.

The tendons of the external (*extensor*) radials slide between the preceding muscles and the posterior surface of the radius ; they soon enter, in their turn, into a fibrous canal not so strong as the preceding, and in which they are separated by a septum which is sometimes wanting : the radial nerve turns over the bone between these latter tendons, the supinator and the abductor longus and extensor brevis pollicis muscles.

v. *The Arteries.*

The Interosseous arteries are the only ones observed in this region. The posterior, after having given off the recurrens ulnaris, ramifies in the superficial muscular stratum, and descends almost to the wrist. It is so large as to require a ligature after amputations. The anterior interosseal does not enter the dorsal portion of the fore-arm until near its inferior fourth part; it remains applied upon the bones, and is so small that it seldom presents any particular indications. The posterior branch of the artery also enters this region about an inch or two above the inferior extremity of the ulna, and it is not uncommon to see it of the size of a crow-quill. In the preceding region, we stated that the radial and ulnar arteries might likewise pass behind the fore-arm by anomaly, etc. As, in these cases, they are always very superficial, they will then render the solutions of continuity more dangerous.

vi. *The Veins.*

The posterior radial and ulnar veins, which are only the continuation of the cephalic of the thumb and of the salvatella, are the two principal. The first is sometimes the largest, at other times the second; frequently one or the other of them are wanting, from their roots soon passing upon the palmar surface. They are more distinct in proportion as they are more inferior, and we see them communicating with each other by transverse branches. We seldom draw blood from them; not because the operation would be dangerous, for they are surrounded by a small number of nervous filaments only, but because there are others much more easy to open and of a larger calibre.

The deep-seated veins follow exactly the course of the arteries.

vii. *The Lymphatics.*

They are not very numerous. Those of the superficial layer gradually turn over the sides of the ulna and radius, but especially

the latter, in order to enter the anterior region; those of the deep-seated parts ascend with the bloodvessels, and follow the same course. This scarcity in the lymphatic system, the hairs which cover the skin, and the other characters peculiar to this membrane in the region under consideration, are the principal reasons why we do not apply to it medicaments, which we wish to have absorbed, in the form of frictions; on the other hand, dry frictions, or simply *revulsives*, will produce more effect upon it than upon the anterior part of the limb.

VIII. *The Nerves.*

The posterior branch of the radial nerve is found externally and superiorly. Its twigs, like those of the posterior interosseous artery, which they accompany almost every where, are dispersed among the fibres of the superficial muscles; a few filaments, however, are lost in the deep muscular stratum. The median and ulnar send off some delicate but numerous filaments near the elbow, which are distributed to the internal and superior part of the region. Inferiorly, we see, internally and externally, the posterior branches of the radial and ulnar nerves immediately applied against the bones; and in the middle, in the bottom of the space, the posterior interosseous filament derived from the median. According to the disposition of these last branches, we conceive that, in fractures near the wrist, they may be painfully stretched, contused, or even divided; and, from their volume, we may expect severe symptoms to follow such accidents. We ought likewise to note the posterior branches of the internal cutaneous and musculo-cutaneous nerves, which ramify in the superficial cellular layer around the veins, but which afford no interest in relation to operations.

IX. *The Skeleton.*

The two bones of the fore-arm, which compose it, are so disposed that the radius is largest inferiorly and the ulna superiorly; whence it follows that, united, they give to the skeleton of the fore-arm nearly equal transverse dimensions throughout its whole extent. It also results from this arrangement, that the former is

more frequently broken superiorly than inferiorly, whereas the reverse takes place with respect to the ulna; and that, when both bones are broken simultaneously, the solution of continuity seldom occurs in the same line. They are convex, and slightly curved upon the faces which are directed towards the circumference of the limb, and are separated, on the side of the median line, by the interosseal space; a space an inch in breadth in some persons, four or five lines in others, and which gradually diminishes in proportion as it approximates the extremities of the region. As this space is closed only by a fibrous membrane, and as the bones become so much attenuated when they reach it that they present a cutting margin, it thence follows that the anterior surfaces of the ulna, radius and interosseous ligament represent a species of fossa, which is deeper and broader in proportion to the degree of separation between these bones: it is in this fossa that the muscles are lodged. The same is observed at the the posterior part; hence the antero-posterior diameter of the fore-arm is naturally shorter than the transverse. Therefore, when these bones are fractured, we place graduated compresses and splints upon the extremities of the first diameter in order to elongate it, and prevent them from approximating. Besides, it may be observed that the displacement of the bones is not difficult to overcome in fractures of the fore-arm. Indeed, in order that the fragments should be displaced longitudinally, it is necessary that both the radius and ulna should be broken together; and even in this case the thing would be difficult, unless the fracture existed quite low down; for the attachments of the muscles being continued upon both divided extremities, they would not tend to make them ride past each other. If the radius only is broken, the two fragments will, it is true, be drawn towards the ulna, superiorly, by the pronator teres, inferiorly, by the pronator quadratus, and the interosseous space will disappear; the osseous portion into which the pronator teres is inserted will also pass before the other; but it is sufficient to relax the muscles, and apply graduated compresses, in order to restore the parts to their natural situation. If the ulna alone is fractured, the displacement can only take place transversely, and that in the inferior fragment; for the articulation of the superior fragment does not admit of its moving laterally. As, in this case, if the fracture exists very low down, the

antero-posterior compression is not sufficiently efficacious, M. Dupuytren has recommended, in order to carry the inferior portion of the fractured bone inwards, to maintain the hand forcibly inclined upon its radial border.

All these fractures may be produced by indirect causes; but they are likewise very frequent from the action of direct causes, especially upon the radius, which is very superficial, and the extremities of which are so placed upon the ulna, that, the latter being supported upon a solid body, an external pressure acting upon the convexity of the other, will not fail, if the force is sufficient, to break it by the effort which would tend to straighten its curvature.

As the radius cannot rotate upon the ulna but at the expense of the interosseal space, it is easy to comprehend why fractures, which are consolidated in a wrong position, will impede, or prevent the pronation of the hand. On the other hand, it is necessary to note that in forced pronation, this space entirely disappears, the radius then swings upon the ulna, and represents a lever of the first order, the power of which is at its inferior portion: whence luxation of its superior extremity backwards. Supination, on the contrary, by separating the bones, tends to luxate the head of the radius forwards: hence this accident is very common in young children whose nurses are in the habit of lifting them by the hand, in order to assist them in making a long step.

In amputations, these bones must be held in a state of forced pronation, in order to avoid jarring the articulations of the radius during the action of the saw. It is for the same reason, and in order that the section may terminate by the least moveable bone, that we recommend the surgeon to hold it inwards.

These operations here present different peculiarities, according to the part of the limb upon which they are performed. The skin, as we have seen, is every where very moveable; it will always be easy to draw it up as far as is required without dissecting it, as was the practice of J. L. Petit; but as the volume of the parts to be covered is less inferiorly than superiorly, it will be necessary to preserve more of it in the latter direction.

If the operation is performed near the wrist, we will only have the radial and ulnar arteries to tie; it will not be necessary to pass the knife into the interosseal space; but, on the other hand,

we will scarcely meet with any thing more than the tendinous portion of the muscles, the synovial tissue and the species of web which constitutes it; the soft parts will have but a slight degree of thickness, and the skin alone will remain applied upon the extremity of the bones.

In the middle portion, on the contrary, the radial, ulnar, anterior and posterior interosseous arteries will each require a ligature; it will be necessary to cut the muscles between the bones; but here the muscular mass is considerable; there are no longer tendons nor synovial membrane in this situation, and it will always be possible to preserve as much of the soft parts as will favour the immediate union of the wound. Therefore, notwithstanding the advantage of preserving a greater length of limb, M. Larrey and other surgeons always advise amputating in the muscular portion of the fore-arm. Nevertheless, with due deference to the opinion of M. Larry, whose authority is doubtless imposing on this subject, we think, with many others, that the amputation should be made as low down as the disease will permit, and observation has sufficiently proved that such cases succeed full as well, and that the cicatrix is quite as firm as when the operation is performed higher up; only it seems to us that, instead of keeping the extremity of the stump more elevated than the elbow, during the subsequent treatment, with the view of preventing a determination of blood towards the part, it would be much better to keep it in a dependent position; for, in the first case, it is evident that the pus, if it forms, and the inflammation will be almost necessarily propagated towards the fold of the arm, through the medium of the retracted tendons and their envelopes, by the cellular tissue, the veins and the lymphatics; whilst, in the latter, all the inflammatory phenomena will be confined to the wound.

Again, the fore-arm is that portion of the limbs which is best adapted for the flap amputation, according to the method of Vermale, if it is true that it presents greater advantages than the circular operation. It is invariably the case, in operating upon the inferior portion of the fore-arm by the latter method, that the tendons and other soft parts will roll under the instrument, will be pressed by it between the bones, and consequently be divided with difficulty; and in amputating higher up, by the same process, that the muscles will also be divided in an unequal manner,

especially externally, and that their section upon the anterior and posterior surfaces of the bones will not always be less difficult. Consequently, it appears to us that the two methods might be combined with advantage, as M. J. Cloquet has proposed; or rather that the operation would be more expeditious and safe by commencing with a circular incision through the skin, which is to be sufficiently raised, and afterwards dividing the muscles by passing cautiously from one side to the other, between them and the bones, a narrow knife, the edge of which would finally be directed perpendicularly to their fibres.

Sect. 3. Borders of the Fore-Arm.

1. The *External, or radial border*, is formed superiorly by the external muscular eminence of the fold of the arm, and is consequently found almost entirely in the anterior region. Below this prominence, the radius is subcutaneous; more inferiorly, we observe the eminence produced by the muscles which pass to the thumb. In order, therefore, to distinguish fractures of the radius by following the external surface of this bone, we must feel along the external groove of the dorsal aspect of the fore-arm. The parts composing this border have already been described.

2. The *Internal, or Ulnar Border*, presents superiorly the side of the internal muscular eminence, which descends lower than the external; inferiorly, the ulna is covered by the skin only; so that the superior half of this bone is actually in the posterior region, and that, in order to ascertain its fracture, it is necessary to trace it behind, in the direction of a line which would pass from the internal part of the olecranon to its styloid process: in the same manner that, with respect to the radius, we would follow another, proceeding from the posterior part of the condyle of the humerus to the styloforme apophysis of the radius.

From what has just been said, we see that, properly speaking, these borders do not exist as distinct regions; that their superior half enters into the palmar aspect, and that their inferior half appertains to the dorsal region: therefore we will not dwell any longer upon them.

ART. V. OF THE WRIST.

This part consists of that assemblage of organs which is comprised between the two regions of the fore-arm and a circular line which would pass below the os pisiforme and upon the root of the thumb; it consequently includes all the articulations of the bones of the carpus with each other, with the bones of the fore-arm and with the hand. Its length is about two inches. It will be divided into two regions, by the two lines which continue the anterior border of the radius and the head of the ulna, towards the carpo-metacarpal articulation of the thumb and the posterior extremity of the fifth metacarpal bone.

Sect. 1. Anterior Region.

Its transverse extent is from two to two and a half inches. In examining its surface, through the skin, we feel, from without inwards;—1st. a prominence formed by the conjoined tendons of the abductor longus and extensor brevis pollicis, a prominence which seems to be continuous above with the anterior crista and styloid process of the radius;—2nd, a *fossette* which terminates the radial groove of the fore-arm, and by which we may penetrate into the joint—3rd, below and within this *fossette*, a second eminence which corresponds to the crests of the scaphoides and trapezium, and which may be readily distinguished when the hand is thrown back. If the thumb and little finger are in contact, and the other fingers extended whilst the wrist is flexed upon the fore-arm, an extremely prominent cord will be seen passing upon the preceding relief: this cord is formed by the tendon of the palmaris longus. In the state of rest, this tendon and the bones just mentioned gradually subside into the middle prominence of the wrist, which is itself formed by the tendons of all the flexors and of the anterior radial;—4th, a second *fossette*, which terminates the ulnar groove of the fore-arm, and which corresponds to the artery of the same name;—5th, the eminence represented by the os pisiforme and the tendon of the flexor carpi ulnaris, and behind which we meet with another *fossette* surmounted by the head

of the ulna ;—finally, in the middle and most inferior part, a superficial excavation which leads into the palm of the hand.

CONSTITUENT PARTS.

I. *The Skin.*

The skin does not present exactly the same characters upon the fore part of the wrist that it does on the palmar aspect of the fore-arm ; it is destitute of hairs, but wrinkles are observed in it in greater or less numbers, according to the age, sex, and embonpoint. Among these wrinkles, three especially are conspicuous, which may serve as guides in operations. The first is found upon the superior limits of the region, half an inch above the styloid process of the radius : it is occasionally wanting. The two extremities of the second terminate at the apex of the styloid process of the radius and of the ulna ; it corresponds to the radiocarpal articulation. Finally, the third, still more distinct than the preceding, is slightly convex downwards ; it separates the thenar and hypothenar eminences, as well as the palm of the hand from the wrist properly so called. By cutting upon it, we would fall directly upon the articulation of the two carpal rows. Below this last the skin is smooth, although thick and more compact : it then makes a part of the palmar integuments of the hand.

II. *The Subcutaneous Layer.*

This layer is formed of very dense and slightly extensible cellular lamellæ and filaments, and never acquires great thickness, although it contains a considerable quantity of adipose vesicles, which are met with in the upper, seldom in the lower, and still more rarely in the middle portion. As this layer is rather fibrous than cellular, and unites the aponeurosis and annular ligament intimately to the skin, serous, sanguineous or purulent secretions can never separate these two membranes ; so that in dropsical persons, as well as in those who are loaded with fat, we observe a kind of strangulation at the wrist. The same thing is pretty generally noticed in women and children. In this layer

the superficial veins and nerves take their course. It is important to distinguish diseases developed in this tissue, from those which are more deeply seated.

III. *The Aponeurosis.*

Above the radio-carpal articulation, it has the same arrangement as was detailed in the anterior anti-brachial region; but below this it is complicated in a very remarkable manner. If we commence with it at the head of the ulna and the os pisiforme, we will perceive that it splits in order to envelope the tendon of the flexor carpi ulnaris, and that it afterwards gives a sheath to the ulnar artery; its laminae are then re-applied upon the fore part of the flexor tendons, in order to separate anew, enveloping the tendon of the palmaris longus in the first place, then that of the flexor carpi radialis, and afterwards forming a sheath for the radial artery; it then passes to fix itself to the anterior border of the styloid process of the radius and becomes blended with the fibrous canal in which the tendon of the abductor longus pollicis runs. Inferiorly, its fibres are approximated, condensed, and thus seem to give origin to the anterior annular ligament of the carpus, before which the tendon of the palmaris longus expands, and is transformed, as it were, into an aponeurosis; which makes the ligament appear as if formed of two layers: one with diverging fibres, appertaining to the tendon; the other, with transverse fibres, the continuation of the aponeurosis. This ligament is attached, on the one hand, to the os pisiforme and the process of the os unciforme; on the other, to the crest of the scaphoides and trapezium. In terminating, this last extremity splits in order to form a sheath for the tendon of the flexor carpi radialis. Its inferior border is continuous with the palmar aponeurosis; in the middle and upon the sides, the fleshy fibres of the thenar and hypothenar eminences derive their attachments from it. We have already said that, superiorly, it was continuous with the aponeurosis. According to this arrangement, the anterior carpal ligament forms the anterior half of a complete elliptical ring, the transverse diameter of which is twenty one lines, and its antero-posterior, one inch only. This ring, or canal, encloses all the tendons of the two common flexors and that of

the thumb; those of the palmaris longus and of the flexores carpi radialis et ulnaris are without it; the median nerve passes through it; but the radial and ulnar arteries, as well as their concomitant nerves, are external to it. As it is very strong and unyielding, it invincibly resists the protrusion of tumours which are deeply situated and forces them towards the hand or fore-arm. We will again recur to this subject.

IV. *The Muscles.*

Strictly speaking, this region does not contain any; we only find in it a very small portion of the superior extremity of the muscles forming the ball of the thumb and little finger, and the most inferior fibres of the pronator quadratus; but if there are no fleshy bundles, we find in it a great number of tendons. Quite externally, we see the termination of the supinator longus upon the base of the styloid process, and the tendons which go to the thumb. These last are included in a very strong fibrous theca, which is lined by a synovial membrane, and they are those tendons which, as we have stated, produce the first prominence observed externally. They are so distant from the articulation that the point of an instrument, entered at the fossette which separates them from the second eminence, might pass between them, from before backwards, without opening the joint. The tendon of the palmaris longus is at first upon the median line; then it descends obliquely outwards and expands upon the annular ligament, with which it is blended. As it is only enveloped by the superficial laminae of the aponeurosis, it is strongly delineated through the skin when its muscle is brought into action, the thumb being at the same time thrown into forced opposition. External to it and a little deeper, we distinguish the tendon of the flexor carpi radialis, the fibrous sheath of which is stronger and more complete than that of the preceding. As it passes to the second metacarpal bone, this tendon dips into a very strong canal which is formed for it by the os scaphoides and trapezium, on the one hand, and the external extremity of the annular ligament on the other. The flexor carpi ulnaris, having likewise a distinct fibrous canal, also raises the skin in the flexion and adduction of the wrist. During the forced adduction of the little

finger, it is sufficiently separated from the bones of the carpus to admit of the passage of a pointed instrument between it and the articulation, without penetrating into the latter. If the instrument was directed obliquely from before backwards, and from without inwards, or even in the opposite direction, it is probable that a similar wound would rarely fail to comprise the artery, and even the anterior branch of the nerve. These different tendons, having each a distinct sheath, are by this means completely isolated from the surrounding parts, so that they may easily act independently of one another.

It is not so with those included by the carpal ring; the flexor of the thumb alone seems separated from the others, and draws with it a portion of the fibro-cellular bursa which envelopes them all. They there form a sort of bundle, in which the median nerve is also found. The membrane which first connects them in a mass, then each in particular, lines the whole interior of the canal which contains them. Although this membrane is thin and translucent, it nevertheless possesses much firmness; its texture is evidently fibrous, and it possesses the greater part of the characters which appertain to synovial membranes. In the natural state, however, we seldom find in it much fluid; it is only lubricated, very slippery, and polished. Below the annular ligament it seems to terminate in a *cul-de-sac*; so that it will oppose the infiltration of pus, serum, etc., in deep-seated affections of the wrist. This membrane is of considerable extent, and like all others of the same nature, it readily inflames when divided by an instrument, or even from simple contact with the external air. This inflammation, which in itself is of a very dangerous nature, becomes still more so from the resistance which the aponeurosis opposes to the inflammatory swelling of the parts, and especially from the species of strangulation which the anterior ligament of the carpus exercises upon it. It is this inflammation which renders wounds, contusions, and all deep-seated diseases of the wrist so dangerous, and which we must apprehend when we perform any important operation upon this part. It is in this bursa that we have most frequently seen those cartilaginous granulations developed of which we treated when on the elbow; granulations which do not appear to differ much, except in volume, from those accidental cartilages which are sometimes met with in the large

articulations ; granulations, finally, which have been regarded as hydatids, but the nature of which we are as yet almost ignorant of. Be this as it may, the tumour which contains them here almost uniformly has the peculiar character of being double, or of the form of a wallet ; that is to say, it projects both in the palm of the hand and fore part of the wrist at the same time, which is undoubtedly owing to the disposition of the anterior fibrous arch of the carpus. This tumour, which does not seem to be susceptible of resolution, produces but little inconvenience, unless it acquires a large volume ; but if the patient wishes to get rid of it, and if the surgeon decides on simply opening it, or passing a seton through it, the operation may be followed by the most serious consequences, even death ; which has occurred several times at Hotel Dieu. In 1822, we saw Prof. Richerand, at the Hospital St. Louis, open a similar tumour in a girl nineteen years of age, of a strong and good constitution. The operation was performed with every necessary precaution ; notwithstanding, intolerable pains ensued, and violent reaction manifested itself ; it was necessary to make numerous incisions, which did not prevent abscesses from forming, and this girl was not out of danger until after six weeks of suffering, combatted by the most energetic measures.

v. *The Arteries.*

In the first place we find the *Radial*, lying upon the fore part of the radius and pronator quadratus ; when it reaches the fore part of the styloid process, it turns backwards and passes through the space which separates the tendons of the short and long abductors of the thumb from the bones, in order to enter the posterior region ; so that it would be possible to discover it in the radial *fossette* of the wrist, and that, if the wound, indicated when speaking of this tendinous prominence, occurred, it would almost necessarily involve this vessel. Previous to changing its direction, the radial artery sends off a small branch to the thenar eminence ; then a second, which runs towards the palmar gutter by passing between the tendon of the flexor carpi radialis and the anterior annular ligament. This vessel is sometimes so large that its division might be dangerous ; and, in such a case, it is so superficial

that it may be exposed and secured. In terminating, it assists in the formation of the superficial palmar arch.

Next the *Ulnar*, which is still covered by the tendon of the flexor carpi ulnaris muscle, and by two aponeurotic laminae, as in the palmar aspect of the fore-arm; therefore, we may also expose and apply a ligature around it by following the directions then given. In some persons it is so superficial that its pulsations may be easily felt in the ulnar groove of this region. In descending, this artery inclines slightly outwards, in order to pass over the fore part of the annular ligament and the radial side of the os pisiforme. In the upper part of the region, that is to say, about an inch above the head of the ulna, the ulnar artery sends off a branch which varies in its dimensions, and which passes directly upon the dorsum of the wrist, crossing the nerve, which is always situated behind and upon the inner side of the arterial trunk. When the volume of this branch is very considerable, it may be readily felt upon the internal border of the ulna; in which case also a cutting instrument, carried upon this side, would promptly reach it, and if we did not reflect upon it, we might be persuaded that the ulnar itself was wounded.

There are no other remarkable branches in this region.

VI. *The Veins.*

The superficial veins form a more or less complicated network. They usually represent an arch, the convexity of which, turned towards the hand, receives many branches from this portion of the limb, and the extremities of which constitute the roots of the median and ulnar veins. In general, the external branches are larger than the internal, and they might possibly serve for venesection; but we seldom open them, because there are always others more voluminous. The deep-seated are applied upon the anterior aspect, or upon that side of the arteries which is towards the central line of the limb. They are of small size and merit but little attention.

VII. *The Lymphatics.*

Disposed as in the fore-arm, they present nothing particular.

VIII. *The Nerves.*

On the inner side, we see the continuation of the anterior branch of the *ulnar nerve*, which runs directly along the external side of the artery and a little posterior to it; externally, some twigs of the radial; in the middle, the median, the volume of which usually equals that of the tendons with which it is mingled. Before the median enters the ring of the carpus it generally gives off its cutaneous palmar branch, which soon becomes superficial and ramifies in the subcutaneous layer, becoming blended with some of the extreme filaments of the internal cutaneous and musculo-cutaneous, which extend thus far. From the small number of sensible cords which are met with in this region, we may be permitted to advance the opinion, that, if diseases are more dangerous here than in many other parts of the body, we must not seek for the cause of it in the nervous system.

IX. *The Skeleton.*

The skeleton comprehends the anterior faces of the bones of the carpus, of the head of the metacarpal bones, and of the extremity of those of the fore-arm. At first sight, the metacarpal bones of the thumb and little finger only would seem susceptible of being luxated forwards; but, on the one hand, if they possess more extensive mobility than the others, and if their ligaments are weaker; on the other, the root of the muscles which are applied upon their anterior surfaces, maintains them and opposes their displacement. The bones of the carpus are covered by a fibrous membrane so strong and compact, that we have no example of their luxation upon the palmar aspect. In fact, in this region there is only the first row of the carpus which can be luxated upon the radius, and the ulna which is susceptible of being displaced forwards. The first of these luxations, without being very rare, is, however, difficult to accomplish; because, on the one hand, the radio-carpal ligament is very strong, and, on the other, because the powers which tend to produce it press the hand firmly backwards: whereby all the flexor tendons are ap-

plied very firmly against the bones, and thus repel them with energy. The ulna is maintained in a less solid manner upon the carpus; but its relations with the radius are so fixed that its luxation forwards must be rare and difficult; we have, nevertheless, met with it several times, and we conceive that it may take place in a movement of forced supination, when the radius, in rotating backwards, tends to tilt in a direction opposite to that which was mentioned when considering its superior luxations. In the movement of forced supination, in fact, if the humeral extremity of the radius cannot slip forwards, and if the force is pretty considerable, the head of the ulna will escape from the cavity which contains it below, and the hand will remain in supination.

In examining all these bones covered by their ligaments, we see superiorly, and from within outwards; 1st, the groove, in which is the tendon of the flexor carpi ulnaris, and which separates the styloid process from the head of the ulna; 2d, an eminence formed by this head itself, and which is more or less prominent according to the position of the hand; 3d, another small groove which corresponds to the radio-cubital articulation; 4th, a second prominence represented by the inferior extremity of the radius, and which terminates externally by a species of crest forming the anterior border of the styloid process; 5th, below this, we find a large transverse semi-circular groove, the convexity of which is directed upwards; this groove leads directly into the articulation of the fore-arm with the carpus; its two extremities separate the apex of the radial and ulnar apophyses from the os pisiforme and from the crest of the os scaphoides; 6th, still lower and upon the radial side, the eminence formed by the trapezium and os naviculare, with the dispositions of which we should be well acquainted in amputating at the wrist, in order to avoid striking against it and making the knife glide upon the fore part of it; 7th, internally, and upon the same line, the prominence of the os pisiforme and unciforme; this deserves still more attention than the preceding, when we perform the flap operation at the wrist; on the one hand, because it is more evident, and on the other, because it would be more easy to disarticulate the os pisiforme, and leave it in the flap; 8th, in the middle, a very deep transverse concavity, which forms the posterior half

of the carpal ring, and which has for its base a portion of the anterior surface of the trapezium, scaphoides, cuneiforme, and unciforme, the whole of the trapezoides, lunare, and magnum.

From what has preceded we find that the order of superposition of the parts here is the following: 1st, the skin; 2d, the cellular layer, dense and compact, enclosing the superficial veins and nerves; 3d, the aponeurosis, which contains in its laminae the tendons of the flexor carpi ulnaris, palmaris longus, and flexor carpi radialis; and still deeper, the radial and ulnar arteries and nerves; 4th, the anterior annular ligament, uniting the aponeuroses of the hand and fore-arm; 5th, the flexor tendons of the fingers and the median nerve enveloped by their synovial bursa; 6th, and lastly, the ligaments and bones.

Sect. 2. The Dorsal or Posterior Region of the Wrist.

Upon its surface we observe, from without inwards: 1st. a *fossette*, about an inch in breadth, limited above and below by the extremity of the radius and the root of the thumb; anteriorly, by the first eminence of the anterior region, and, externally, by the species of cord which is represented by the extensor longus pollicis; the radial artery crosses the bottom of this *fossette*, the depth of which is much more apparent when the thumb is in abduction and extension; 2d. the thumb being in the same position, and the indicator extended whilst the other fingers are flexed, another excavation of less depth, but broader, limited externally by the tendon of the extensor longus pollicis, and internally by that of the extensor indicis, which excavation is divided by the tendon of the extensor radialis brevis into two triangular portions; one, external, containing the head of the second metacarpal bone and the termination of the radial artery, a little more externally; the other, on the contrary, internal, having its base towards the radius, and which will guide us directly into the joint; 3d. another *fossette*, which corresponds to the interval of the extensor tendons of the ring and little fingers; 4th. more internally, a small excavation, which is also found between this last tendon and that of the extensor carpi ulnaris; in this is situated the head of the ulna, which sometimes projects considerably; 5th. the depres-

sion which separates the tendons of the flexor and extensor carpi ulnaris, as well as the two regions of the wrist internally. These different excavations, circumscribed by as many eminences, permit, on the one hand, pointed instruments to enter into the articulations, without dividing the tendons; and on the other, to synovial tumours, and *nodi*, to project under the skin.

CONSTITUENT PARTS.

I. *The Skin.*

This is supple, extensible and covered with numerous hairs in man; it is less delicate than upon the palmar surface, and contains some indistinct sebaceous follicles. Although uneven and rough, it does not present any complete wrinkles; it only seems as if the epidermis was too large for this region, and therefore thrown into folds in all directions. The skin upon the dorsal surface of the wrist is always of a darker hue than that of the anterior region.

II. *The Subcutaneous Layer.*

It preserves all the characters which it possessed in the forearm, and therefore differs much from the subcutaneous layer of the anterior region: hence tumours may be developed under it as in the rest of the limb, and increase to pretty large dimensions. This layer equally contains the superficial veins and some nerves; but is destitute of, or contains but very few fatty cells, at least in the vicinity of the posterior annular ligament, to which its adhesion is stronger than elsewhere; from which circumstance this portion, in children, females and fat subjects, or where the arm is œdematous, appears as if strangulated.

III. *The Aponeurosis.*

From the styloid process of the radius to that of the ulna, the aponeurosis forms a very strong broad arcade, destined to bind down the tendons, to which it furnishes separate sheaths: this is the ligamentum carpi annulare posterius. The different canals

to which this ligament gives rise from without inwards are: 1st, behind and external to the styloid process of the radius, a very strong theca directed obliquely forwards and downwards, for the tendons of the extensor brevis (*extensor secundi internodii*) and abductor longus pollicis (*extensor primi internodii*): this sheath constitutes a complete canal, and when it is divided into two by a septum, the extensor (*secundi*) tendon lies posteriorly. 2d, another theca, which descends perpendicularly, and encloses the tendons of the extensores radialis longior et brevior; 3d, the fibrous canal which envelopes the tendon of the extensor longus pollicis (*extensor tertii internodii*): this canal is oblique in the same direction, as the first, and is only complete below the radius; more superiorly it is separated from the sheath common to the extensors of the fingers only by a slightly extensible fibro-cellular lamina; 4th, the canal, or rather the proper posterior carpal ring, through which the tendons of the extensor communis and indicator pass; 5th, a separate sheath for the extensor minimi digiti; 6th, between the styloid process and the head of the ulna, another *theca* for the tendon of the extensor carpi ulnaris. On the side of the anti-brachial region, this ligament gradually becomes thinner, its fibres separate, and are finally blended with those of the aponeurosis. Its inferior margin is converted into a fibro-cellular lamina, which is at first very thin, but afterwards becomes thicker as it passes to the hand.

IV. *The Muscles, or rather Tendons.*

The tendons of all the extensor muscles of the fingers and hand traverse the posterior region of the wrist. They are twelve in number, and were made known when describing the sheaths which they derive from the aponeurosis. Those which form the external limit of the fossette of the first metacarpal bone, were seen when on the palmar surface. The extensores radialis longior et brevior diverge as they descend; they are usually separated in their sheath by a fibrous septum, and crossed by the extensor pollicis longus, which is itself interposed between the fossette of the first metacarpal bone and that of the second. The four tendons of the extensor communis, and that of the indicator

are disposed in their ring, like those of the flexors anteriorly ; that is to say, that a sort of very strong, fibrous, synovial membrane envelopes them, and permits them to slide easily, either separately or conjointly. This membrane does not, however, form a complete bursa, and seems less complicated than that of the anterior region. It lines all the *thecae*, and covers all the tendons which run through them. The same surgical remarks will apply to it as to all other organs of the same nature : nevertheless, as the circumjacent tissues are less dense than in the anterior region, its inflammations generally produce less acute pain and less formidable symptoms. We have not met within it those cartilaginous corpuscles which were mentioned as sometimes existing in the palmar portion ; but those synovial tumours called *nodi*, or ganglions, are frequently developed in it. It is true that these tumours may also depend upon a species of hernia of the articular synovial capsule ; but most frequently it is the membrane under consideration in which they are situated. In this case, as in the other, it is always dangerous to open these species of cysts, in consequence of the inflammation which frequently ensues, and which rapidly extends from the incised sac into all the tendinous sheaths, to the fore-arm, hand, etc. There is at present in the hospital of *la Faculté*, an adult female, who has had one of these tumours over the track of the extensor longus pollicis for six years, and which she was desirous of getting rid of. A young surgeon wished to try the radical cure for hydrocele ; he punctured it, injected a small quantity of cold water into it, and recommended rest ; an intense fever supervened, abscesses formed in the *thecae*, fore-arm, and upon the back of the hand, etc. ; it became necessary to make several incisions, and this woman is not yet out of danger, although more than a month has elapsed since the operation.

v. *The Arteries.*

The *Radial* is the largest, and is the only one which deserves some attention. As it is passing behind the root of the thumb, in the fossette of this finger, in order to reach the first interosseal space of the metacarpus, it is deeply seated and is crossed by the tendons of the extensor pollicis brevis and abductor lon-

gus pollicis, on the one part, and the extensor pollicis longus, on the other. In order to discover it in the excavation which separates these tendons, we would have to divide only the skin and a pretty thick layer of cellular tissue.

The dorsal artery of the carpus and the posterior branch derived from the ulnar, are generally too small to require any particular attention in operations. The first is crossed by all the extensor tendons, and traverses the region below the posterior annular ligament; the second, already pointed out in the preceding region, crosses the posterior surface of the ulna obliquely, from within outwards and from before backwards, so that it is crossed in its turn by the tendons of the extensor carpi ulnaris and extensor minimi digiti.

VI. *The Veins.*

Those which appear through the skin are generally very large; their number varies greatly, but they are usually collected internally and externally in order to form two principal trunks; the internal, most constant and voluminous, was called *Salvatella*, by the ancients; the external is chiefly made up of the veins of the first two fingers, and constitutes the *Cephalic of the thumb*. The first ascends, under the name of ulnar, and the second, under that of radial, behind the fore-arm. Formerly, venesection was often performed in these veins; but at present we seldom have recourse to it, unless those of the fold of the arm cannot answer the purpose.

The deep-seated veins present nothing particular.

VII. *The Lymphatics.*

These vessels pass from the hand and fore-arm, and are arranged in the same manner as in these regions: they do not present any thing requiring particular notice.

VIII. *The Nerves.*

Some filaments of the cutaneous nerves of the brachial plexus ramify around the veins and terminate in the superficial layer of

the dorsum of the wrist. We also observe in this region the posterior branch of the radial nerve, which here divides into an internal and external cord. On the inner side, the posterior branch of the ulnar nerve bifurcates in like manner: their different branches creep in the aponeurotic layer, and cross the most of the tendons, so that a cutting instrument might possibly divide them, without involving the latter; and as it would then be impossible to extend the fingers, we might easily be mistaken as to the nature of such wounds.

IX. *The Skeleton.*

It is remarkable for the number of bones and articulations which enter into its composition.

Superiorly and transversely, from its outer to its inner border, we observe, 1st. upon the radius, different crests which separate the tendinous sheaths: these crests should be noticed, as they are sometimes so prominent that they might possibly be mistaken for exostes; 2d. the gutter which the tendons of the extensor communis traverse, and which corresponds internally to the radio-cubital articulation; 3d. the head of the ulna, which naturally makes a prominence under the skin, between the tendon of the extensor minimi digiti and that of the extensor carpi ulnaris.

Below the bones of the fore-arm there is a narrow, convex part, representing the posterior surface of the bones of the carpus, and which unites the hand to the fore-arm. Superiorly, this species of neck presents a transverse semi-circular groove, with superior convexity, which corresponds to the radio-carpal articulation. This groove deserves the greatest attention when we amputate the wrist, because, if the knife should fall below it, it would enter between the two rows of the bones of the carpus; if above it, we would be liable to denude the radius and ulna. In order to find it and penetrate directly into the joint, or rather to perform the operation in question, divers methods have been recommended. In one, the surgeon makes a circular incision through the skin below the inferior transverse line which it presents in the anterior region, dissects and raises it, divides the tendons, and then removes the hand by traversing the articulation from the apex of the external styloid process to the internal. in

the direction of the groove just indicated. In the other, having marked the anti-brachial styloid processes, a semi-lunar incision with inferior convexity is made through the integuments; the cellular bridles are divided, and the skin drawn up by an assistant; the posterior tendons are then cut across, and, in order to disarticulate, the point of the knife is passed into the articulation, under the apex of the styloid process of the radius, and makes a semi-circular incision, in an inverse direction to that which was made through the skin; all that is then to be done is to form the anterior flap, which is the principal, taking care to avoid the pisiforme and the crest of the scaphoides. If, in either of these two methods, we carried the instrument directly across from one styloid process to the other, we would separate the two rows of the carpal bones; by following the curved line just mentioned, this error will always be avoided, whether the incision commences at the radial or cubital border; it is more sure, however, to begin upon the outer side, because the scaphoides is more inclined under the styloid process of the radius, whilst the apex of that of the ulna falls exactly on a level with the articulation of the cuneiform with the unciforme bone.

By a third method, the instrument is carried transversely flatwise, between the bones and the soft parts, to the fore part of the radio-carpal articulation. In this way we commence by forming the anterior flap, which we raise; then we make an incision upon the dorsal surface of the wrist, as in the preceding case, and the disarticulation is effected in the same manner as by the first process.

The anatomical disposition of the parts permits the belief that we may succeed by either of these methods of operating. The first, adopted by Sabatier and followed by most English surgeons, is certainly as easy and certain as any other: it even has the advantage of forming a more regular wound, and of rendering the apophyses less liable to remain uncovered; but it is not always possible to cut the skin so low as to admit of the union of the soft parts by the first intention.

The second is more expeditious, and as we may give much length to the flaps, especially to the anterior, an immediate reunion will readily take place. We must mention, however, that as the skin is not of so great a length at the angles of the wound.

it is more difficult to cover the bones exactly, which are larger and more prominent in this situation than in the middle. Lastly, the third, which appertains to M. Lisfranc,* presents nearly the same advantages, and may also be followed by the same inconveniences.

It should also be observed, that in the first method, the dissection of the skin, which is easy upon the dorsal surface, requires caution upon the palmar surface, on account of the compact texture of the cellular tissue, and that this reason alone should prevent us from commencing the operation at the anterior part, by the flap method, even when there are sufficient soft parts behind to cover the osseous extremities.

As the articulatory surfaces of the bones of the fore-arm are so disposed that they form a very deep transverse concavity, and as their apophyses are about two inches and a half asunder, whilst the antero-posterior diameter of the radius is not more than an inch; the radio and cubito-carpal ligaments being also very strong, it follows that internal or external luxations of the wrist must be very rare, and that they cannot be complete without the previous laceration of numerous parts. On the other hand, as the corresponding articular surface of the bones of the carpus is pretty regularly convex, we cannot easily comprehend how incomplete carpal luxations can occur in either of these directions; behind and before, on the contrary, the osseous margin is scarcely prominent, and the ligaments only can oppose some resistance to the displacements, which are likewise favoured by the natural movements of the hand. We have already mentioned in what manner the luxation forwards is effected: the opposite displacement is produced by the same mechanism; but it is more rare, because the osseous extremities are less disposed to slip in the latter direction, and because the hand turns less easily forwards than backwards.

The same cause which occasions the luxation of the head of the ulna forwards, in forced supination, will also produce its luxation backwards, in pronation, when the head of the radius is solidly maintained upon the humerus.

We would observe, finally, that the two bones of the fore-arm

* Coster's Manual of Surgical Operations, &c., Godman's translation, p. 48.

may be separated by those causes which would tend to produce lateral luxations, and that this species of *diastasis* is pretty frequent, even in fractures of the inferior extremity of the ulna and radius.

With respect to the bones of the carpus, they afford too slight a hold for the action of external powers, their ligaments are too numerous and firm, to permit their luxation upon each other. There is one, however, which is less solidly encased, the rounded head of which is susceptible of being driven from the cavity which encloses it; this is the *os magnum*: as it is thicker posteriorly than anteriorly, the displacement always occurs in the former direction; at least this is the observation of Chopart and Boyer. Among the carpo-metacarpal articulations, the first only admits of luxation. In fact, it is isolated from the others, and its surfaces are enveloped by a species of capsule, which is sufficiently loose to accommodate them to the movements of the thumb; but it is almost impossible for this accident to take place forwards, on account of the muscles of the thenar eminence; or inwards, on account of the facet of the *os trapezium* which looks outwards and forwards, and which permits the abduction to be carried very far without the surfaces abandoning each other; finally, or directly outwards, because in adduction the thumb is soon stopped by the metacarpal bone of the indicator. Posteriorly and externally, however, the first metacarpal bone is covered only by the skin, an aponeurotic expansion of but slight strength, and the fibrous capsule, which is also weaker in this direction; besides, the articular facets are less extensive from before backwards than transversely, and the movement of opposition is that which the thumb most frequently executes. The only resistance then to the cause of displacement is afforded by the extensor tendons of the thumb. As for the rest, this articulation is easily felt through the integuments, in the summit of the *fossette* situated behind it. We will have occasion to revert to this, however, when speaking of the hand, in relation to the amputation of the thumb.

Although the articulation of the fifth metacarpal bone with the *os unciforme* is so disposed as to admit of some motion, yet it is not so moveable as to permit its luxation; but it deserves notice, on account of the operations which are performed upon it. Its surfaces are plane and slightly oblique inwards; its dorsal and

palmar transverse ligaments are strong, and must be divided when we adopt the method of M. Lisfranc, before we attempt to depress the bone and introduce the point of the instrument into the joint.

With respect to the three other articulations, they are almost entirely immovable. We should observe, however, that the posterior extremity of the second metacarpal bone is surmounted by two processes which are prolonged upwards for the insertions of the flexor carpi radialis and extensor carpi radialis longior, and that the third presents a similar prolongation for the extensor carpi radialis brevis, which would render their disarticulation more difficult.

In the dorsal region of the wrist the different organic strata are arranged in the following order: 1st. The skin; 2d. the cellular layer; containing the superficial veins and nerves; 3d. the aponeurosis and annular ligament; 4th. branches of the radial and ulnar nerves; 5th. the tendons and their synovial envelopes; 6th. the deep seated arteries and veins; 7th. the bones and their ligaments.

ART. VI. OF THE HAND.

The hand is comprised between the inferior limits of the wrist and the roots of the fingers; it forms an irregular square, and is divided by the acromio-digital and sub-scapulo-digital lines, into the anterior or palmar region, and the posterior or dorsal region.

Sect. 1. The Palmar Region.

It is more extensive than the dorsal region, and is prolonged some lines backwards upon the wrist, and forwards upon the articulation of the fingers. Upon its surface we observe, 1st. externally, a muscular prominence, the apex of which terminates at the thumb; this is the *thenar* eminence; 2d. internally, another eminence longer, but narrower, extending posteriorly as far as the os pisiforme: this is the *hypothelar* eminence; 3d. anteriorly, when the four fingers are approximated, three risings formed by the skin, which correspond to the intervals of the digital roots; 4th. in the same position, three grooves which separate these last

prominences; 5th. in the middle, an excavation terminating externally and posteriorly in the indicator on the one part, and which is continuous with the median groove of the wrist, on the other; this is the hollow, or palm of the hand; 6th in this hollow several lines are observed which are pretty constant; one takes its origin from the anterior and external extremity of the palmar gutter, and almost immediately bifurcates in such a manner that the first of its branches makes a semi-circular turn in order to circumscribe the thenar eminence, whilst the second passes at first transversely and afterwards forms a semi-lunar curve in order to terminate upon the posterior part of the hypothenar eminence; another line seems to originate from the place where the first terminated, that is to say from the wrist, and descends vertically upon the middle of the preceding; finally a third extends from the interval which separates the indicator from the medius, to the base of the little finger, cutting the hypothenar eminence into two unequal portions. Its convexity looks backwards and outwards, so that, united with the line of the indicator, it somewhat resembles an X with lengthened branches. Each of these three furrows appear to be produced by particular movements; thus the first is owing to the movement of opposition of the thumb and may be called the *thumb line*; the second, to the flexion of the other fingers, in conjunction with that of the thumb when we wish to grasp a cylindrical body, for example, and we may name it the *indicator line*: the third seems to depend upon the momentary extension of the index finger whilst the others are flexed upon any body whatsoever; this is the *line of the little finger*. By uniting the transverse portion of the last two, we have a furrow crossing the fore part of the hand about three lines behind the metacarpo-phalangeal articulation, which might be called the *metacarpal furrow*. These different creases require attention when it becomes necessary to make incisions into the hand.

CONSTITUENT PARTS.

1. *The Skin.*

It is generally very thick throughout the whole extent of this region, but preserves a certain degree of suppleness upon the

thenar eminence; elsewhere it is dense, compact, and almost inextensible; it is destitute of hairs and sebaceous follicles. In labouring people, the natural polish of its surface is changed into rough callosities, which increase its thickness, and render inflammations of this part among them more severe and dangerous.

In addition to the lines indicated above we find a great many others which are owing to the arrangement of the papillæ of the corpus mucosum. These papillary lines are so disposed that, upon the thenar eminence they form curves, the concavity of which is towards the thumb, whilst, upon the hypothenar, they are circular in its posterior half, and almost transverse anteriorly. Those of the hollow of the hand diverge as they approach the intervals of the fingers, in such a manner as to receive in their span the convexity of the small groupe of curved lines in the vicinity of the roots of the digital appendices. The skin of cicatrices presents nothing analogous to this arrangement.

II. *The Superficial Layer.*

Before the head of the metacarpal bones, and upon the hypothenar eminence, this layer consists of a very dense filamentous cellular tissue, which unites the deep-seated textures solidly to the skin, and contains a great number of small adipose vesicles. This structure constitutes a species of elastic cushion, which varies but little in thickness, and is prolonged upon the fingers. Upon the thenar eminence, the cellular tissue is rather lamellated than filamentous, and consequently unites the aponeurosis less firmly to the skin; whence also it follows that the phenomena of its inflammations, abscesses, and tumours differ but little from those in other parts of the body, whilst, in the rest of the region, the compact texture of the parts gives rise to very severe symptoms. In the hollow of the hand this layer is much thinner; the filaments and lamellæ are more approximated and blended, as it were, with the aponeurosis and the skin: it no longer contains adipose vesicles, and consequently no elastic cushion.

III. *The Aponeurosis.*

In the palmar excavation this fascia is at first very strong, after-

wards it becomes gradually thinner externally, forming only a simple cellular lamina upon the thenar eminence, where it is lost in the preceding layer. As it passes towards the inner border of the hand, it also becomes more attenuated, and gives origin to the palmaris brevis muscle. If we trace it towards the wrist, we will find that it is only a continuation of the tendon of the palmaris longus and ligamentum carpi annulare anterius; the diverging fibres of the former and the transverse of the latter, although pretty intimately intermingled, are nevertheless distinct where the aponeurosis is strongest. As it approximates the anterior part of the hand, those of the palmaris longus are collected into four diverging *bandalets* which bifurcate in order to embrace the root of each finger, applying themselves upon the flexor tendons, or rather becoming blended with the thecæ of these tendons. Those of the annular ligament or the transverse fibres, become less and less distinct in proportion as they advance, and soon form only small arcs of circles, which also apply themselves upon the tendons, before they reach the first phalanx, and in this manner seem insensibly to give origin to the thecæ of the tendons.

In the palmar aponeurosis there are various apertures formed by the separation of its fibres at the place of their intersection. Some of these openings are very small, others of considerable size; becoming larger and more numerous towards the fingers: they are filled with cellular tissue or fatty processes, by means of which a communication is formed between the superficial and deep-seated parts. These foramina seem to concur in producing those acute pains consequent upon inflammations in the hollow of the hand, by the strangulation of the tumefied parts which their margins must produce; and hence the necessity of enlarging them early in these diseases.

iv. *The Muscles.*

Some appertain to the thenar eminence, others to the hypothenar eminence; the palm of the hand also has its distinct muscles.

The first constitute the external muscular mass, and are:—1st, the abductor brevis, which especially covers the carpo-metacarpal articulation of the thumb, and which is there strengthened by

the tendon of the abductor longus; this is one of those which most strongly oppose the luxation of the first metacarpal bone forwards; 2d, the flexor brevis and opponens pollicis, which also prevent the displacement in the same direction and inwards, not by applying themselves upon the joint, but by acting upon the bone as upon a lever of the third order; as they are fixed very far from the point of support, they must act with much force; 3d, the adductor pollicis, a fan-like muscle, placed transversely, which acts in the same direction as the last two in opposing luxations, especially inwards; indeed it resists still more powerfully, because it is inserted at a right angle into the bone which the force tends to throw backwards.

The second form the internal muscular prominence. In it we find, first, in the cellular layer, the palmaris brevis, stretched over the superior fourth of the aponeurosis, which it fixes to the internal surface of the skin, towards the ulnar margin of the hand: it is this which produces that small depression observed within and below the os pisiforme when the thumb and little finger are brought into forcible adduction; next the adductor (*abductor minimi digiti*) attached to the os pisiforme, and apparently continuous with the tendon of the flexor carpi ulnaris: therefore, when the little finger is thrown into adduction, the latter tendon is rendered very tense; finally, the flexor parvus, vel proprius minimi digiti, which is frequently confounded with the preceding; and deeper still the abductor (*opponens minimi digiti*), which is one of the palmar interossei.

Those of the palm are the lumbricales, which can only be considered as appendages to the tendons of the flexor profundus, favouring their action upon the fingers by their insertion into the dorsal surface of the first phalanges; and the first two palmar interossei which present nothing peculiar.

Besides these different muscular bundles, all the flexor tendons of the fingers pass through this region; we consequently find in it the four tendons of the flexor sublimis, as well as those of the profundus, all of which diverge towards the metacarpo-phalangeal articulations, where they enter into their sheaths. That of the thumb slides between the two portions of the flexor brevis muscle, and also passes on to its theca. Under the aponeurosis, all these tendons are enveloped collectively and separately by a

synovial membrane, entirely similar to that of the wrist, of which it is only the continuation. This membrane is liable to the same diseases, which are attended with equal and even greater danger, on account of the resistance made by the fascia to the inflammatory tumefaction of the parts.

v. *The Arteries.*

The ulnar and radial arteries terminate here, forming two arcades called "palmar arches." One of these arcades is superficial, and is situated between the aponeurosis and the skin; its convexity looks downwards, and it is found about sixteen lines below the annular ligament; its external extremity is continuous with the radial artery, through the root of the thenar eminence. On this side the superficial palmar arch is small, unless the artery gives off a larger anterior branch than usual. Internally, it passes towards the ulnar artery, of which it is the continuation, and consequently its volume is greater than externally; we find it directly upon the radial side of the os pisiforme, and in order to follow its direction it is easy to imagine a semicircle sixteen lines in depth, the extremities of which would rest upon the pisiforme and the crest of the scaphoides. According to this disposition, we perceive that this arch is very liable to be wounded, in which case it would be very difficult to secure it in the situation of the wound, on account of the compact texture of the tissues. If we wished to operate immediately, it would be necessary to tie both the radial and ulnar arteries; but this is not always necessary, for the aponeurosis affords so much resistance, that compression will, generally, succeed in arresting the hæmorrhage. Four principal digital arteries originate from the convexity of this arch, which pass onwards to bifurcate at the base of the fingers, in the interval of the fibrous *bandelets* of the aponeurosis; it also gives off several considerable branches which ramify in the thenar and hypothenar eminences; so that throughout the whole palmar surface of the hand, the skin and superficial layer receive large and numerous arteries, or give passage to these vessels.

The deep palmar arch is less curved than the superficial; its convexity is directed a little inwards and backwards; it lies be-

tween the flexor tendons and the interossei muscles; its internal extremity originates from the ulnar artery, of which it forms the deep branch. As this branch separates from the trunk it passes through the posterior extremity of the flexor parvus minimi digiti, in order to get behind the tendons. The other extremity passes between the adductor and flexor brevis pollicis muscles, into the posterior part of the first interosseous space, where it communicates with the radial artery, to which it actually belongs, and which also furnishes two very large deep branches to the muscles of the thenar eminence, along the ulnar side of the first metacarpal bone, and the radial border of the second. The convexity of the deep palmar arch gives off four or five small branches which follow the direction of the interosseal spaces, and which communicate, near the head of the metacarpal bones, with twigs from the dorsal artery of the metacarpus; this arch also distributes forwards, backwards, and from its concavity, several other ramuscles which anastomose with the superficial, dorsal, etc., arteries.

From the arrangement of these two arches it follows, that all the arteries of the hand communicate extensively with each other, and that the ulnar and radial form a very long loop, which is double inferiorly, where its base is, single in the fore-arm, where it is prolonged to the brachial trunk. Therefore, when one of the branches of this loop is wounded, we cannot effectually arrest the hæmorrhage without applying a thread upon each divided extremity of the artery; and when they are the seat of a spontaneous aneurism, it is prudent to put a ligature above and below the vessel.

We have seen a specimen in the possession of Prof. Bécларd in which all the arteries of the fore-arm and hand were excessively dilated, and their tunics at the same time very much thickened. The palmar arches formed a very complicated plexus, since all the branches were of the size of a goose-quill; they were tortuous, undulated; finally, their disposition was precisely similar to that of those large varicose knobs frequently observed upon the vena saphena: indeed, we might say, that these arteries were in a state of hypertrophy. It is unnecessary to observe that in the subject to whom this specimen originally belonged, the

slightest wound in the palm of the hand would have occasioned a dangerous hæmorrhage.

VI. *The Veins.*

Upon the thenar eminence the superficial veins still preserve a certain volume; they are smaller upon the hypothenar eminence and still smaller in the palmar hollow; they follow the distribution of the superficial arch, and enter the anterior veins of the wrist.

The deep-seated accompany all the branches of the corresponding arterial arch, and pass into the deep radial and ulnar veins. These vessels have no relation with operations.

VII. *The Lymphatics.*

The superficial form three or four trunks, which are generally met with upon the fore part of the muscles of the thumb and which pass to the anterior aspect of the wrist. The deep lymphatics are in contact with the arteries, communicate with the superficial set, and equally pass to the fore-arm.

VIII. *The Nerves.*

We meet with, upon the thenar eminence, some superficial twigs from the radial, and filaments from the small cutaneous palmar branch of the median are distributed in the cellular layer of the palm of the hand; the hypothenar receives the two terminating branches of the ulnar. These last two cords separate on a level with the pisiforme, on the outer side of which their common branch is situated like the artery which it accompanies. The first passes to the last two fingers, applied upon the muscles of the internal eminence, and covered by the fatty cushion and palmaris brevis muscle. In its course it leaves one or more branches upon the internal part of the hypothenar. The second passes through the posterior extreimity of the opponens and flexor parvus minimi digiti muscles, on the inner side of the hook of the os unciforme, and forms an arch upon the fore part of the

interossei muscles, like the deep arterial arch. It would seem that this branch appertains to the muscles, whilst the preceding is chiefly distributed to the skin. Be this as it may, it is easy to perceive that the ulnar eminence of the hand is much more abundantly supplied with nerves than the radial, and consequently that its diseases must be attended with much more acute pain. Finally, the median terminates in this region in giving origin to four or five large branches, which diverge as they pass onwards, and bifurcate at the roots of the first four fingers. All these branches lie under the fascia, running between it and the tendons of the sublimis; previous to reaching the fingers they only give a small filament to each lumbricalis muscle.

ix. *The Skeleton.*

It represents a species of grate (*grillage*), concave transversely and from before backwards, formed by the anterior face of the five bones of the metacarpus, the intervals between which are broader than upon the posterior aspect. The transverse concavity of the metacarpus is occasioned by the posterior extremities of the bones being cut in the form of as many small wedges, the edges of which are turned forwards, and also to the carpal row which corresponds to them being likewise concave. Its antero-posterior curvature depends upon its proper bones, and proceeds from the expansion of their phalangeal extremity anteriorly and laterally, and it is also in consequence of this disposition that the interosseous spaces are broader in the middle than before and especially than behind. In the latter direction, the bones of the metacarpus are, as has been already mentioned, very solidly fixed; but their head, or their anterior extremity, is only maintained by means of the transverse metacarpal ligament, before which the tendons, nerves, and arteries of the superficial arch run, whilst the interossei muscles pass behind them. We will recur to the peculiarities which relate to these bones, in the dorsal region, when we come to speak of the amputations of some of them.

The following is the order of superposition of the different organs examined in the palmar region: 1st, the skin; 2d, the superficial layer, including the ulnar palmar arch, a part of the ulnar nerve, and the palmaris brevis muscle: 3d, the aponeurosis: 4th,

the branches of the median nerve ; 5th, the muscles of the internal and external eminences ; the tendons of the flexors, the lumbricales ; 6th, the radial palmar arch ; the deep branch of the ulnar nerve, the interossei interni muscles ; 7th, the bones.

Sect. 2. The Dorsal Region.

It is less complicated than the preceding, and its surface presents, when the fingers are extended and separated, 1st, five cords, which converge towards the wrist, produced by the tension of the extensor tendons ; 2d, three grooves between these tendons, which increase in breadth as they pass to their termination at the origin of the fingers ; 3d, externally, when the thumb is in adduction, a prominence which depends upon the first dorsal interosseous muscle, and behind which is observed the excavation of the indicator, which was mentioned when on the dorsal surface of the wrist ; 4th in the anterior part of this fossette, behind the muscular eminence, when the thumb is in abduction and opposition, we readily feel the posterior extremity of the first two metacarpal bones, separated by a notch several lines in breadth, in the bottom of which we find the radial artery at the instant it is about to penetrate into the palmar region in order to form the deep palmar arch ; 5th, anteriorly, when the hand is shut, the eminences produced by the metacarpal heads, the most prominent of which supports the middle finger.

CONSTITUENT PARTS.

1. *The Skin.*

It differs but little from that of the corresponding regions of the wrist and fore-arm ; its thickness is greater towards the sides than upon the middle of the back of the hand ; near the ulnar border, it is covered with hairs, and contains numerous sebaceous follicles ; it becomes polished as it approximates the fingers, and presents numerous superficial wrinkles which intersect one another in various directions.

II. *The Subcutaneous Layer.*

This lamina is very thin and very supple, and contains but few or no adipose cells; its characters are the same as in the wrist; it encloses the superficial veins, nerves, etc.

III. *The Aponeurosis.*

The fibrous sheet of the back of the hand is thin, and rather cellular than truly aponeurotic; its fibres are transverse and seem to originate from the annular ligament; in passing towards the fingers, it frequently contracts adhesions with the tendons, becomes thicker, stronger, more distinct, and is lost anteriorly in the cellular tissue. A second lamina of a similar nature covers the posterior surface of the bones and interossei muscles. This deep lamina is blended with the superficial near the metacarpophalangeal articulations; posteriorly, with the ligaments of the carpus, and laterally again with the superficial aponeurosis: so that between these two sheets the tendons and principal nerves are found, and that, in inflammations and suppurations, the deep lamina opposes the passage of the disease or its products into the palm of the hand, whilst the superficial hinders them, for some time, from making a visible and circumscribed prominence under the skin.

IV. *The Tendons and Muscles.*

The tendons are seven in number: one for the thumb, two for the index, two for the little, and two others for the ring and middle fingers. These different tendons have not the same form; that of the thumb is narrow and cylindrical; those of the indicator, that of the extensor proprius minimi digiti, frequently consist of two bandelets, which expand over the metacarpophalangeal articulation, and are blended with the tendon which each receives from the extensor communis: those of the indicator, placed one behind the other, are usually spread out in the form of a ribbon. All these tendons send off processes from their borders, which, with the tendons of the little finger, form a membrane on the

back of the hand, resembling a duck's foot. This disposition satisfactorily accounts for the greater or less facility with which we can move this or that finger. Thus, the indicator, the thumb, the little finger, extend and move very well, though the others remain in a state of inaction, because each receives several tendons, one of which at least does not depend upon the common extensor; the movements of the middle and ring finger, on the contrary, are, if I may so say, tied to those of the little finger and indicator; and the extension of the fourth finger is impossible during the flexion of the third, because there exists between their tendons too intimate a connexion.

The synovial membrane which lines their anterior surface, does not form for them a particular bursa. Thinner and less distinct than that of the flexor tendons, it is nevertheless more frequently the seat of synovial ganglions, which we have frequently seen very large, becoming inflamed, bursting, and giving rise to fistulous ulcers. These tumours may be limited to a single finger, or extend to all, to the wrist, and thus cover the entire dorsum of the hand; and, when increased to this degree, if they inflame, they will seldom be cured without serious symptoms; indeed, we are frequently obliged to amputate the member. We are, however, acquainted with a medical student who has long had a similar disease; the greater part of the knobs which it formed suppurated; several have been opened, with the bistoury, upon the wrist, the root of the thumb, metacarpus, etc. Numerous leeches have been applied, at different intervals; the whole of the affected part no longer formed but a spongy mass, from the inferior fourth of the fore-arm to the middle of the fingers. Several celebrated surgeons had already thought of amputation, and the young man had almost consented to it, when we recommended to him resolvents and the application of a compressive bandage; an amelioration was soon apparent, and now the cure is almost complete; a small fistulous point upon the posterior surface of the wrist is all that remains, through which a small drop of synovial fluid issues daily.

The muscles are the four dorsal interossei, among which we distinguish the first particularly, both on account of its volume and because the radial artery traverses it posteriorly. The others fill more or less completely the interosseal spaces, and

their posterior extremity also gives passage to an artery: it is the posterior perforans, which goes to communicate with the deep palmar arch.

v. *The Arteries.*

The radial artery merely enters this region in order to penetrate into the palmar through the most remote part of the first interosseal space. Its relations to the articulation of the trapezium with the first metacarpal bone are such, that it is almost always divided in the extirpation of the latter; but it would be possible to avoid it by carrying the edge of the bistoury close upon the bone which we wish to remove. The other arteries of the back of the hand originate from the transverse metacarpal, which also gives off the dorsal interossei and the anterior and posterior perforating branches. The posterior branch of the ulnar also anastomoses with the metacarpal artery, and both are applied directly upon the deep sheet of the aponeurosis. It is seldom that any of these branches are so large as to exact any precaution during surgical operations.

vi. *The Veins.*

The deep-seated accompany the arterial twigs just mentioned; the others, or the subcutaneous veins, vary in number and are very large. Those of the first two fingers unite in order to form the cephalic of the thumb; those of the last three are generally collected on the inner side, and give rise to the salvatella. These veins run in the superficial cellular layer, and, as this layer seldom acquires much thickness upon the back of the hand, we sometimes perform venesection upon the metacarpus, when we experience too much difficulty at the fold of the arm; in which case there are no important arteries or nerves to avoid, and the tendons only require some attention.

vii. *The Lymphatics.*

They are few in number, and soon turn over the borders of the hand, in order to become continuous with those of the palmar

aspect. In this region, as well as in the preceding and the wrist, lymphatic glands have never been discovered.

VIII. *The Nerves.*

Externally, we find the radial, one of the branches of which ramifies upon the thumb and the metacarpal bone which supports it, whilst the other subdivides into two branches, which are distributed to the index and middle fingers. Internally, we see the posterior branch of the ulnar, which is disposed in the same manner as that of the radial, and which passes to the last two fingers. These nerves penetrate between the tendons and the two aponeurotic laminæ: they seem to appertain to the sensitive system.

IX. *The Skeleton.*

The skeleton of this region comprises all the bones of the metacarpus, which are less distant from each other than in the palmar aspect, on account of their being broader behind than before, and they also present a convexity instead of a concavity. The first metacarpal bone being shorter, thicker, more moveable, and more thickly covered by the muscles than all the others, it follows that it cannot be easily fractured; but it is occasionally affected with caries, necrosis, or other diseases which render its extirpation necessary.

A great many methods of performing this operation have been advised; but there are three which are generally adopted. In the first, two incisions are made, commencing from the point where the abductor longus pollicis muscle is inserted, and carried one behind and the other before, uniting them on the inner side of the root of the thumb; after which the bone may be easily dislocated.

In the second, the bistoury is at first thrust from without inwards, and from the dorsal towards the palmar aspect, across the root of the thenar eminence, in order to form a flap which is prolonged to just beyond the metacarpo-phalangeal articulation, and which we raise in order to penetrate into the joint by its external part, and remove the bone by shaving its ulnar surface.

In the third, we carry the bistoury, its cutting edge being turned backwards, from the middle of the commissure of the thumb and index finger down to the os trapezium, by gliding it along the first metacarpal bone ; we then disarticulate, and finish the operation by forming the external flap.

In certain cases, the pathological state of the parts will doubtless oblige us to adopt one of these processes in preference to the others ; but where the surgeon can make a selection, the following is what the anatomical arrangement teaches concerning the respective advantages and disadvantages of these operatory methods : In the first, the incisions are more regular ; it is easy to avoid the radial artery, and the flaps can be more exactly adapted to each other, because they are only divided upon one of their borders ; but the disarticulation is difficult and sometimes very tedious, because we cannot sufficiently incline the bone in adduction in order to luxate it. The wound is necessarily prolonged behind the joint, the flaps are quite thin in this direction, and the osseous surfaces cannot always be properly covered.

In the second, the flap is more speedily formed ; we enter more easily into the joint ; the arteries may be as readily avoided, and the articular surfaces will be better covered ; but the flap is frequently unequal, and it is not always possible to give it sufficient thickness.

In the third, we obtain almost all the advantages of the two others, without incurring their inconveniences. In fact, this method is easy, certain, and expeditious. It must only be recollected, that by pushing the instrument too far backwards we would cut the radial artery, and by its penetrating between the os trapezium and trapezoides might remove the former with the metacarpal bone : but this mistake, which, however, would be attended with only slight inconvenience, will not be committed, if we take care to direct the edge of the bistoury obliquely outwards, in order to cut the capsular ligament, when it arrives opposite to the termination of the abductor longus pollicis, at the same time that we endeavour to luxate the bone inwards. This process, advised by M. Lisfranc, seems to us to merit the preference.

The last four metacarpal bones being longer and more immoveable than the first, it follows that they may be occasionally

fractured, especially by direct violence. For example, when the palmar surface is laid flat upon a solid plane, if a foreign body produces forcible compression upon it, it will tend to efface their natural curvature, and may break them in their middle portion. Fractures from an indirect cause, although rare, are not impossible. We have seen a water-carrier, in whom the third metacarpal bone was broken from being drawn forcibly by the index and middle fingers by a cart-man.

All of these bones may be amputated in their continuity, when their head is disorganized, or even for a simple disease of the finger, when we wish to remove the annoying thickness of this head.

When we perform this operation we should always penetrate through the hand from the dorsal towards the palmar surface: in the first place, because on the dorsum the bones are easily felt through the skin; and, in the next place, because, as they are broader in this direction than anteriorly, we are more certain of making the two incisions depart from the same point, and of uniting them upon the anterior surface, so as to have only a single division, susceptible of cicatrizing by the first intention.

Although it might be possible to remove the last four bones of the metacarpus at their posterior articulation, it would nevertheless be difficult, especially with regard to the two in the middle, which are more compactly wedged between the two others. If we wished to amputate that which supports the index finger in this manner, we should recollect that its posterior extremity receives two tendons, and that its articular surface is slightly oblique outwards; which would oblige us to carry the knife between the indicator and middle finger.

With respect to the fifth, the operation is not much more difficult than for the first, and the same methods have been applied to it; as the fourth also rests upon the anterior face of the *os unciniforme*, by adopting the third process recommended for the thumb, we need not fear making the same mistake relatively to the bones of the carpus. This method also appears to us to be preferable, unless under some peculiar circumstances. By following it, it will always be easy to have a flap of suitable thickness, provided we take care, the point of the bistoury being held upwards and its cutting edge backwards, to incline the han-

dle of this instrument towards the thumb, in order that the anterior incision may go to terminate upon the origin of the median line of the palm of the hand, whilst the dorsal incision tends to prolong itself towards the head of the ulna. In this manner, the whole of the hypothenar eminence will be preserved, and the point of the bistoury will easily penetrate between the articular surfaces, which are slightly inclined inwards and backwards. M. Lisfranc here recommends a process which is the same, in the main, with that which we pointed out in the second place for the disarticulation of the metacarpal bone of the thumb, but which, upon the dead body, has always appeared to us more difficult and more complicated than the preceding. We think that it should only be resorted to in those cases in which we have decided upon removing the metacarpal bone without taking away the finger which it supports, as has once been successfully done by M. Roux. Finally, whatsoever method the surgeon may adopt, the articulation will always be easily recognised from the surface, by carrying the extremity of the finger along the internal posterior border of the bone which we wish to extirpate, when the first prominence which he meets with behind will be that which results from the union of its posterior head with the os unciforme. It may be observed, before abandoning this point, that, by following the advice given by M. Lisfranc for the amputation of the fifth metacarpal bone at the joint, the two arterial palmar arches might be avoided, whilst, by the other methods, they would almost to a certainty be divided; but as the application of the ligatures will not present any peculiar difficulties, we think that it will have little or no effect over the consequences of the operation, and therefore ought not to be brought into comparison with the inconveniences which would result from the multiplicity of incisions required by the former.

The arrangement of the different layers of the back of the hand is so simple, that it is almost useless to describe it anew. However, we find, 1st, the skin; 2d, the cellular layers and veins; 3d, an aponeurotic lamina and some nervous filaments; 4th, the extensor tendons, the nervous branches of the radial and ulnar, the synovial envelope; 5th, a second fibrous sheet and the arteries; 6th, and lastly, the bones and interossei muscles.

ART. VII. OF THE FINGERS.

Placed parallel to one another, conical and more slender in children and females, cylindrical in most men, all the fingers are far from having the same length. The medius is the longest of all; the index and ring fingers usually terminate upon the same line, although in reality the indicator is the shortest, because its metacarpal bone is the longest; the little finger terminates on a level with the last articulation of the ring finger, and the thumb at some lines behind the first phalangeal articulation of the indicator. The phalangeal articulation of the thumb is exactly upon the same line as the metacarpo-phalangeal articulation of the indicator, which is one of the most important circumstances to be noticed, as it may assist us in our endeavours to penetrate into these articulations.

Sect. 1. Palmar Region of the Fingers.

Upon this surface the fingers present a considerable number of furrows, with which it is useful to be well acquainted: there is one only before each of the last phalangeal articulations, and, by incising perpendicularly upon it, we fall about a line behind the joint. There are several, but two in particular, before the middle articulations. Of these, the posterior is the most constant; it is this which corresponds to the joint and which would, if incised upon, lead not more than half a line behind it. A similar furrow is observed at the union of the palmar portion of the hand with the fingers; but this furrow does not bear the same relations to the articulations as the preceding. It is nearly an inch in the anterior region of the hand that the metacarpo-phalangeal union of the fingers is met with; to this, however, the thumb forms an exception, for, before its corresponding articulation, we may observe a furrow, which is disposed as in the middle joints. We would, moreover, be sure to fall upon the metacarpo-phalangeal articulation of the thumb, by prolonging upon its base, when it is in forced abduction, a line parallel to the direction of the index finger.

Between these different furrows, we also observe some wrin-

kles, which are occasioned by the plication of the skin, and which are parallel to the direction of the fingers.

CONSTITUENT PARTS.

I. *The Skin.*

This membrane is of a dingy colour; it is polished, firm, very thick, smooth, dense and compact. It has not yet been ascertained whether it possesses sebaceous follicles: but as we have acquired the conviction that, upon the other parts of the body, variolous pustules generally have their seat in these organs,* and as small-pox pustules are developed upon the fore part of the fingers, we are induced to believe that these follicles really exist in it. This membrane is covered with an innumerable quantity of papillary lines, arranged in various directions, but which, upon the pulp, generally take the form of as many small ellipses.

II. *The Subcutaneous Layer.*

Upon the anterior part of the body of each phalanx, this layer forms a very remarkable elastic cushion, the thickness of which varies in different subjects, but never exceeds certain and even somewhat restricted limits. This cushion is always thickest upon the last phalanx and passes a few lines beyond it, forming the pulp of the fingers; it consists of fibro-cellular filaments which seem to be detached from the skin in order to intersect each other a great number of times, and thus form an infinite number of small compartments, in which adipose vesicles are imprisoned: these vesicles are small, never entirely disappear, nor become so large as to deform the fingers. When they partially collapse in thin persons, the fingers are flattened and their articulations appear more prominent; if, on the contrary, they are distended, the fingers become rounded, and the articular furrows deeper. It is to the mixture of the adipo-cellular vesicles with the fibrous filaments, that this layer owes its elasticity, and its slight extensibility. It is intimately united with the

* Voyez *Archives générales de Médecine*. Cahier de Juillet, 1825.

skin and fibrous sheaths of the tendons; all the nerves and vessels pass through and are even distributed to it. Before the articulations, the fibrous tissue exists alone, and connects the skin very firmly to the tendinous sheaths; at the free extremity of the fingers, the pulpy substance is attached directly to the bone; behind the last transverse grooves, it forms the anterior elastic part of the hollow of the hand.

It follows from this anatomical disposition, that acute inflammations must be easily developed in this layer, since it contains some cellular tissue and numerous vessels; that these inflammations must be productive of very acute pain, on account of the density of the tissue, the nerves which ramify in it, and the resistance which the cutaneous layer must oppose to the tumefaction. Let us suppose, for instance, that a needle had penetrated through the skin, if the cellulo-adipose tissue inflames, the elements, which then have a tendency to swell, will be squeezed between the two articulations, on the one part, and between the fibrous sheath and the skin, on the other; they will thus be, as it were, strangulated, and will be more firmly compressed in proportion to the violence of the inflammation; therefore, it is well known that, in order to remove the very severe pain arising from whitlow, the best plan is to make deep incisions upon the palmar aspect of the inflamed finger. When the inflammation is further advanced, and pus is secreted, the species of sac into which the fluid will be forced to collect, meeting with extreme resistance on all sides, on account of the thickness of the skin, we conceive that the inflammation will extend back into the rest of the finger, into the hand and even the fore-arm, and hence all the dangers of not making free incisions into the part in the commencement of the disease. If it is too true that the whitlow which has its seat in this layer is a serious disease, we must take care and not mistake it for that form of onychia which is called whitlow of the first species, and which is only a simple inflammation of the corpus mucosum of the skin. In fact, the latter is never very painful, and only deserves attention on account of the constant tendency which the pus has to detach the epidermis extensively, and especially around the nail; a circumstance which is owing to the great thickness of the cuticle upon the fingers, and which exacts, if we wish to stop the disease, an early remo-

val of the epidermis thus detached, in order to expose the whole of the diseased surface.

III. *The Tendinous Sheaths.*

These sheaths here supply the place of the palmar aponeurosis, and are, if I may so say, only a modification of it. The terminating bandelets of the latter, are, in fact, evidently continuous with their longitudinal fibres, and the small arcs of a circle which form the greater part of the sheath, and seem to be merely the continuation of the transverse fibres of the aponeurosis. These canals are completed, posteriorly, by the anterior surface of the phalanges; their transverse section has the form of an ellipse, the small diameter of which is shorter upon the articulations than before the bodies of the phalanges; their anterior or fibrous half is principally formed of transverse curves; of very strong and very close fibres forming a very thick layer, the borders of which are inserted into the sides of the osseous part. This lamina is thinner before the articulations, especially the middle one, than in their intervals: we not unfrequently see small spaces between their fibres, which make a communication between the interior of the sheath and the preceding layer, and through which small fatty bodies, or processes of the synovial membrane of the tendons, penetrate from one to the other; it is also through these apertures that the inflammations mentioned above, are transmitted to the serous tunic of the sheath, and that the latter may escape when it is inflamed, so as to become strangled, and thereby occasion extremely acute pains. At least, it is in this manner that some persons account for those violent sufferings which certain patients experience who are afflicted with whitlow of the third species, and which is supposed to have its seat even in the tendinous theca. When these thecæ have passed beyond the third articulation, their tissue becomes rarefied, and they are blended with the pulp and periosteum: their interior is lined by a perfect synovial membrane, which does not communicate with that of the articulations. When it arrives at the palm of the hand, this membrane gradually disappears in the fibro-cellular tissue which envelopes the flexor tendons, or rather it forms a species of *cul-de-sac* upon the fore-part of the trans-

verse metacarpal ligament, and thus constitutes a small elongated pouch which has no opening, the functions as well as the diseases of which, are, to a certain degree, independent of those of the other organs of the same nature. It is proper to remark that, upon the fore part of all the articulations, and especially of those of the metacarpus with the phalanges, these sheaths are altogether fibrous; which is owing to the transverse ligament here forming their posterior part, covering entirely the articular surface.

iv. *The Tendons.*

Each theca includes two tendons, except that of the thumb, which contains only one. These cords are so disposed that the tendon of the *sublimis* muscle, which is at first applied upon the other, gradually splits into two bandelets, which diverge in order to give passage to that of the *profundus*: whence it follows that previous to this division, the first is concave upon its deep surface, whilst afterwards, it is its superficial surface which presents a gutter. The two bandelets then turn and approach each other below, and are inserted into the anterior and lateral parts of the second phalanx, blending themselves with the periosteum and the fibrous sheath. The tendon of the *profundus* muscle, on the contrary, terminates upon the anterior surface of the last phalanx, previous to which, however, it detaches a flat fibrous plate of greater or less strength, which is inserted into the first phalanx, but which does not interfere with its free motion. This process, called *fulciforme* by some anatomists, may explain how it is that some persons are able to flex the first phalanx with facility, after the last two have been amputated, even when the ends of the tendons have not been blended by the effect of inflammation, with the flap which covers the extremity of the stump. Surgeons who have advised amputation at the metacarpo-phalangeal joint, when the disease would have permitted the operation in the middle articulation of the finger, were, without doubt, ignorant of this anatomical peculiarity, when they advanced that by allowing the first phalanx to remain it would only be in the way, since it must necessarily remain immoveable. And it is probably for the same reason that others have advised making several deep incisions upon the palmar surface of this phalanx.

with the view of producing adhesion of the tendon to the surrounding parts, previous to amputating either of the other phalanges.

The thumb has no flexor sublimis tendon, whence it follows that the movements of its first phalanx are more limited than those of the other fingers. Finally, all these tendons are of a very dense texture; their fibres, which are mostly parallel, are very firmly compacted together; they are covered by the synovial membrane which lines their sheath: they are white, smooth, and almost inert: therefore, when they remain for some time in contact with the air, they slough and become foreign bodies. It is the same when the interior of their sheath suppurates, or at least they then become agglutinated to the other tissues, and the fingers remain immoveable.

v. *The Arteries.*

Each finger has two principal arteries, which are called collateral, and are distributed in the following manner: When the most considerable trunks of the superficial palmar arch arrive opposite to the interval which separates the heads of the metacarpal bones, each of them bifurcates, and the two branches of this bifurcation immediately pass upon the sides of the two corresponding fingers; they then apply themselves upon the sides of the tendinous sheaths, which they are almost in immediate contact with, although enveloped in the superficial layer; near the free extremity of the finger, they turn towards each other and anastomose, forming a loop or an arch in the digital pulp. In their course, these branches give off several twigs to the celluloadipose layer, which are entirely distributed to this membrane; they are very large in proportion to the organs which receive them, and it is well known that the arterial system abounds in the fingers. It is not necessary, however, to secure them in amputations, for compression is generally sufficient to stop their bleeding. They are always situated behind the collateral nerves, and in such a manner that a transverse incision may be made upon the palmar aspect of the finger down to the theca, without wounding them: it also follows that these vessels will not be divided except from incisions made upon the sides of the fin-

gers: finally, when we amputate at the metacarpo-phalangeal joint, two ligatures only will be necessary, whether the division of the tissues has comprised the arterial trunk itself previous to its bifurcation, or only one of the arteries on each side.

Some small arteries, the terminating twigs from the branches furnished by the deep palmar arch, are also distributed to the palmar face of the fingers; but they are only important as they concern the nutrition of the organs.

VI. *The Veins.*

They are as numerous as the arteries; the superficial run in the subcutaneous layer, are of considerable size, and accompany the collateral arteries; the others are smaller, scarcely distinct, they follow the arterial ramuscles of the deep palmar arch, and form the roots of the radial vein, collateral to the artery of this name.

VII. *The Lymphatics.*

One or two of these vessels are situated upon each side of the fingers; they accompany the arteries or blood vessels in general, and are of no great importance in surgery.

VIII. *The Nerves.*

They are distributed exactly in the same manner as the collateral arteries, before which they are situated; the palmar nerves of the fingers are all derived from the median and ulnar. The former supplies the thumb, index, and middle fingers, and one of its branches also follows the radial border of the ring finger, at the extremity of which it anastomoses, in the form of an inverted arch, with the ulnar, which besides supplies the little finger. As these extremely large branches are placed before the vessels, they may be wounded without the arteries being touched; they ramify and are entirely lost in the subcutaneous elastic layer and skin; which leads to the belief that all these nerves appertain to the sensitive system: therefore the fingers are endowed with a remarkable sensibility, which constitutes the most wonderful

of their functions. From the great quantity of nervous filaments, distributed throughout the first two layers of the palmar aspect of the fingers, we may also account for the agonizing pains before spoken of.

IX. *The Skeleton.*

We have only to consider here the anterior surface of the phalanges and of their articulations. All these small bones are slightly concave transversely and longitudinally, which enables us, in amputations, to cut a flap of sufficient breadth and thickness upon the palmar aspect of the fingers. All of these articulations bulge out a little; the last two transversely, the first in a spherical manner: whence it follows, that, if we amputate the first or second phalanx, in commencing by cutting a flap from within outwards upon the palmar surface, as recommended by M. Lisfranc, the surgeon should be careful to stop the base of this flap on a level with the furrow which we have noticed upon the surface, and not carry the bistoury backwards farther than the middle of the first eminence which he will meet with in ascending from the free extremity towards the root of the organ; that, in another process, advised by the same author, and which consists in falling directly upon the joint, we should also take great care how we carry the instrument behind this eminence, because the species of neck upon which it would then strike, will deceive the surgeon, and he may be embarrassed for a long time before he discovers his error. The fold of the skin is also a sure guide to prevent making this mistake; but it must not be forgotten, that the only furrow which we see behind the digital pulp, will conduct directly upon the neck in question, if we do not cut about a line before it, since the articulation is actually a little anterior to it; that, as it regards the union of the first two phalanges, it is always the most remote of those grooves which are found before the joint, which must be recollected, and that this groove is seldom more than half a line posterior or anterior to the articulation.

With respect to the posterior articulation, we would find it by following a slightly curved line with an anterior convexity, the extremities of which would fall behind the index and little fin-

gers, about three lines before the transverse groove of the hand. But, as we do not penetrate into this joint by the palmar surface, we will defer the further consideration of it until we come to treat of the dorsal portion.

Sect. 2. Dorsal Region of the Fingers.

This aspect is longer than the anterior, because in the latter the palm of the hand is prolonged, as we have seen, upon the posterior third of the first phalanges. Its surface presents, when the fingers are extended, the termination of the three grooves mentioned when describing the back of the hand; grooves which, by uniting the dorsal and palmar faces, form a thin and concave border, which we may call the *commisure of the fingers*. Between these grooves, we observe the reliefs produced by the continuation of the extensor tendons. During flexion there exist three strongly marked angular eminences for each finger, which correspond to the articulations, but in such a manner that it is always the anterior phalanx which has glided over the posterior, and the head of the latter alone projects under the skin; a circumstance to be recollected when we amputate. In all positions, but more especially in semi-flexion, there are many transverse wrinkles observed upon the posterior digital surface, scarcely perceptible upon the bodies of the phalanges, but always very distinct in the immediate neighbourhood of the joints. There are generally three of these furrows upon each articulation: one before, another behind, and the third in the middle. The last is generally the deepest, and it is about two lines before it that the incision must be made, if we cannot discover the anterior, in order to penetrate into the joint. It is necessary to note, however, that this disposition does not exist with respect to the metacarpo-phalangeal articulations.

CONSTITUENT PARTS.

1. *The Skin.*

The skin is uneven, plicated, and supports a group of hairs, in the adult man, upon the bodies of the first two phalanges; it is

more coloured, supple, and extensible than that of the palmar surface, but it is also much thinner, less dense and compact; except by its folds, it scarcely differs from that of the back of the hand; it also contains some distinct sebaceous follicles. When it comes near to the nail, it is, in the first place, reflected back upon its root, to the extent of about a line and a half or two lines, and in this manner forms for it a species of *matrix*, which we should not fail to cut perpendicularly and in the direction of the contour of this horny production, when we wish to extirpate the latter; indeed, by taking this precaution, we would diminish the excruciating pains which this little operation usually produces. Next, the integuments slide under the borders of this inert plate, and become continuous, under its free edge, with the skin of the pulp of the fingers; its texture is then much more compact; the dermis adheres almost directly to the bone, and it is the epidermis more particularly which envelopes the root of the horny plate; now, as it is between these two laminæ that the pus or morbid fluids, consequent upon onychia, accumulate, we need not be surprised that the nail afterwards drops off.

II. *The Subcutaneous Layer.*

This layer is merely the continuation of that of the back of the hand, and is also entirely different from that of the palmar aspect. In the point under consideration, it sometimes contains fatty cells of a certain volume; upon the articulations, its laminæ are united, condensed, and frequently transformed into a sort of *saccus mucosus*; as they approach the nail, they become more dense, and are blended with the periosteum and skin. The veins and nervous filaments run between them, and the diseases which are developed in this layer are attended with the same phenomena as in the corresponding aspect of the hand, of the fore-arm, etc.

III. *The Aponeurosis.*

There is none, properly speaking; this layer is confounded with the tendons.

IV. *The Tendons.*

These cords are somewhat complicated: when they have passed beyond the metacarpo-phalangeal articulation, they receive upon their borders the tendons of the lumbricales and interossei muscles, which may thereby become flexors of the first phalanx. Behind the first phalangeal articulation, the extensor tendon expands and even separates into two bands, united by a thinner membrane, and thus passes upon the second phalanx. The two bands then approximate and afterwards separate anew, in order to cover the last joint, and finally terminate near the nail. These tendons have no sheaths; but the membrane which continues their margins fixes them in a pretty solid manner upon the back of the fingers, so that they cannot, under any circumstance, slip to one side or the other. They are not enveloped by a synovial membrane, but they rest immediately upon those of the articulations and upon the body of the bones; a very supple and extensible lamellated cellular tissue enables them to slide with facility.

V. *The Arteries.*

These arteries are very delicate and almost capillary; they are derived from the transverse metacarpal, the interosseus branches of the deep palmar arch, and the collaterals. Wounds, therefore, upon the back of the fingers do not occasion troublesome hæmorrhage.

VI. *The Veins.*

They are of considerable size; upon the dorsum of the first phalanx they sometimes form a species of plexus, and may generally be perceived through the skin. In short, the veins are much larger here than those upon the anterior aspect, and pass to the salvatella or the cephalic of the thumb.

VII. *The Lymphatics.*

They form the root of the lymphatics of the back of the hand, communicate with those of the palmar surface of the fingers, and are not more important, as relates to surgery, than the latter.

VIII. *The Nerves.*

The posterior branch of the ulnar supplies the little and ring fingers, and also the ulnar side of the middle finger; the radial nerve supplies the thumb and indicator, and generally sends a small branch to the middle finger also. According to this arrangement, we perceive that a wound inflicted upon the ulnar side of the wrist would partially paralyze the last three fingers, whilst a similar injury upon the radial side would act upon the first three only. However, as these nerves, as well as the branches of the median upon the palmar surface, apparently belong to sensation alone, it would be interesting, and not unimportant, to ascertain if it would be possible to paralyze the fingers completely, by dividing the nerves at the lower part of the forearm, without touching the tendons.

IX. *The Skeleton.*

We will here examine the phalanges and the head of the metacarpal bones, or rather these different bones and their articulations. The shortness of the former and their great mobility, render their fractures very rare, and almost prevent the occurrence of these accidents unless by direct causes. With respect to luxations, they are more readily produced in some articulations than in others. In the metacarpo-phalangeal articulations, for example, they are less frequent in the three middle fingers than in the first and last. In this respect, see what anatomy teaches us: anteriorly, the joint is firmly secured by the anterior ligament, the flexor tendons and their thecæ; the flattened bands of the extensors are found alone behind; the lateral parts are maintained by two strong ligaments, and strengthened by the tendons

of the interossei and lumbriales. On the other hand, the head of the metacarpal bones is so much inclined forwards, that the phalanx may turn upon it so as to form a right angle, without the articular surfaces thereby losing their natural relations: the luxation, therefore, will be so much the more difficult in this direction, as the fibrous parts oppose an extreme resistance to the displacing powers; and also, as the articular surfaces admit of very extensive motion, which is, besides, checked by the palm of the hand itself, before the osseous surfaces can abandon each other. On the dorsal side, on the contrary, no ligaments, no fibrous sheaths; a single tendon, thin and affording but little resistance, because its adhesion to the joint is very slight; articular surfaces, which tend to be displaced whenever the movement of extension passes a little beyond its natural limits, and nothing upon the back of the fingers to check this movement; these are so many circumstances favorable to dislocations backwards. Although this is an arthroïdial articulation, its lateral displacements are, nevertheless, very rare; in the first place, on account of the strength of the lateral ligaments; and in the second, because the movements of abduction and adduction are naturally very limited. With respect to the little finger, the luxation must be more common forwards, on account of the adductor and flexor brevis muscles, which are inserted into the first phalanx. It would also seem, that in the thumb it would be still more readily produced, on account of the muscles of this finger, which are stronger and more numerous; but this advantageous disposition is counterbalanced by the presence of the ossa sesamoidea, which sometimes very considerably augment the extent of the articular surface of the first metacarpal bone; it should also be noted, that these supernumerary bones partially convert the articulation under consideration into a ginglymus. Moreover, when this displacement has once occurred, the muscles must afford great opposition to the reduction. Prof. Boyer, who does not appear to have met with this species of luxation, thinks, however, that if it existed it might be easily reduced; whilst he says, that he himself, as well as Chopart and Desault, had failed in reducing certain dorsal luxations some days after the accident. We have only once seen the first phalanx of the thumb pass before the first metacarpal bone; but this case is in direct opposition to

the opinion of the celebrated surgeon just cited. The subject was a female, aged 45 years; the luxation had existed three days; there was no inflammation. We endeavoured to reduce it, but all our efforts were unavailing. M. Prof. Bougon also made vain attempts on the day following; and four days afterwards, Prof. Roux, notwithstanding his well-known skill and dexterity, was equally unsuccessful.

The fibrous elements which surround the phalangeal articulations, are absolutely similar to those which we have seen in the preceding; but the articular surfaces differ from them, inasmuch as they form a complete ginglymus; lateral luxations of them, therefore, must be still more difficult. In order that these displacements may take place forwards, they must overcome the same difficulties; the condyles of the first phalanx are as much rounded anteriorly as the head of the metacarpal bones, and the flexion of the fingers may be carried still farther: it is posteriorly, then, that the luxation is most likely to occur. It is proper to observe, however, that the condyles of the second phalanx are not so much inclined upon the dorsal surface as those of the first; whence it follows that the last phalanx would be luxated forwards more easily than the bone with which it is articulated: this luxation, on the contrary, is more common in the thumb, and there are persons who can produce and reduce it at pleasure; which can only depend upon the laxity of the ligaments and the particular disposition of the articular facets in such persons.

In relation to amputations, the skeleton of the fingers also presents some remarkable peculiarities: thus the convex form of the back of the phalanges will, in most cases, prevent the formation of a dorsal flap of sufficient breadth or thickness, even if the thickness of the soft parts would permit it; it is for this reason that the English recommend making a circular incision through the skin three or four lines before the joint, in order to form afterwards two flaps, by making two other incisions upon the borders of the phalanx; but for this method, as well as the circular method in general and many other modifications, those which were pointed out when on the palmar surface are advantageously substituted, and especially that which consists in making a semi-lunar incision through the skin and flexor tendon upon the anterior cutaneous furrow of the articulation, or two

lines before the middle fold: we then fall exactly into the joint; only, in order to traverse it, we must take care to cut the two lateral ligaments, and to recollect that the condyles of the posterior phalanx look directly forwards, in order that we may incline the handle of the instrument less backwards. Besides, as the articulation is very close, and as the extremity of the phalanx which we wish to remove makes a considerable bulge, it will be necessary to use an instrument with a narrow blade, and to carry the edge of it sufficiently forwards in order to be able to place it horizontally and form the flap, by shaving the palmar aspect of this bone.

The metacarpo-phalangeal articulation being of a different kind, the steps of the operation are no longer the same when we amputate the first phalanx. After having made a flap by means of a semi-lunar incision, the convexity of which corresponds to the middle of the commissure of the fingers, and the extremities of which fall before and behind the articulation, in order to discover the latter, it is sufficient, as M. Lisfranc has very correctly stated, to draw the edge of the bistoury backwards along the phalanx, its point being at the same time directed upwards. The first prominence which we then meet with is the head of the phalanx; the articulation will always be found some lines farther, and in order to traverse it, all that is necessary is to divide the ligaments and tendons with the extremity of the instrument held transversely, whilst we endeavour to luxate the bone with the other hand. Moreover, it is always easy to discover this articulation; the prominence which the metacarpal heads form externally, sufficiently shews the place which it occupies; and if the morbid swelling prevented us from seeing this prominence, we should recollect that the joint is always eight or ten lines behind the digital commissure. Finally, as all the metacarpal joints are upon a slightly curved line, almost regular, at least with respect to the last four, and as the palm of the hand is prolonged upon the palmar surface of the first phalanges, it follows that, if the occasion should require, we might amputate the four fingers simultaneously; that is to say, that we might make a curved incision, convex anteriorly, upon the fore-part of all the articulations, afterwards penetrate into each of them separately, and finish the operation with a knife, forming only a single flap for all the fingers, at the expense of the palmar part of the hand. This pro-

cess, advised by M. Lisfranc, has always appeared to us simple and very easy upon the dead body.

After the amputation of a single finger in its articulation with the hand, the head of the metacarpal bone forms a projection which, after the cure, keeps the two collateral fingers very much separated for a considerable time. Some surgeons have supposed that this inconvenience might be avoided by amputating in the continuity of the metacarpal bone, and that in this case the deformity would be less. It is true that the operation is easy; but it is undoubtedly much more painful than the other; in fact, we are obliged to divide a much greater thickness of the tissues, and the cicatrization will not always be so prompt; besides, the volume of the head gradually diminishes, by the gentle pressure which the surrounding parts constantly exercise upon it, and the roots of the two fingers become at length much more approximated than we would at first have imagined.

CHAPTER IV.

OF THE CHEST.

The Chest forms the middle cavity of the body, and is continuous, superiorly, with the neck, inferiorly with the abdomen, and serves as a point of attachment to the superior extremities. The figure of its skeleton is that of a truncated cone with an inferior base. When it is surrounded by its soft parts, on the contrary, its superior part is broadest; in this direction it appears as if flattened: and its transverse diameter, from shoulder to shoulder, is greater than its antero-posterior. This form presents gradations infinitely varied, according to age, sex, and individuals. Anatomists having for a long time, divided the skeleton of this cavity into four regions, and as this division can be pretty exactly traced upon the surface, we are induced to follow it, with the exception, however, of pointing out slight modifications which appear to us indispensable, in speaking of the principal sections.

In the first place we will examine the thorax properly so called, or the containing parts; in the second, the cavity of the thorax and the contained parts.

ART. I. OF THE THORAX.

Sect. I. Anterior or Sternal Region.

It is bounded, superiorly, by the infra-hyoideal and supra-clavicular regions ; inferiorly, by a curved line which unites the epigastrium to the chest, and laterally, by the two clavi-coxal lines which separate it from the axillary region above, and from the costal region, properly so called, below. The surface of this region presents, in the middle and from above downwards, the supra-sternal notch, much deeper in emaciated than fat persons ; a depression which corresponds to the os primi-sternal (Béclard) ; an eminence, which does not always exist, and which depends upon the more or less angular junction of the primi et duo-sternales ; a second depression, more constant than the first, of which it is sometimes the continuation, and which generally increases in depth in proportion as it approximates the fore part of the xiphoid appendix, upon which we almost always observe an excavation, and the point of which occasionally forms a relief under the skin ; upon the sides, the prominences produced by the heads of the clavicles ; below, in thin individuals, a series of hollows and risings which are in relation with the intercostal spaces and the cartilages which circumscribe them ; in fat persons, on the contrary, we remark a prominence, elongated parallel to the axis of the body, and which is owing to the muscles and the celluloadipose tissue. Childhood, sex, embonpoint and constitution occasion numerous modifications in these different features. Thus, in the first age, this region is generally very protuberant, and forms a considerable arch ; there is no relief upon the sides. In women it is flatter and shorter ; but the breasts cause the median groove to appear deeper, and the clavicular extremity is more prominent ; in some adults, the sternal region projects as in childhood, and this disposition, which frequently coincides with rachitism, induces us to apprehend phtisis pulmonalis. In others, on the contrary, it is more depressed than in the well-formed state, as is observed especially in mechanics who labour with the trunk habitually curved forwards, and which they make use of as a point of support, shoe-makers, for example ; finally, it is not very uncommon

to meet with a certain degree of mobility upon the median line, and some inequalities which depend upon the imperfect or irregular union of the different pieces of the sternum. It is especially necessary to recollect these varieties, when it is required to determine the existence of fractures or tumours which frequently manifest themselves in this region.

CONSTITUENT PARTS.

I. *The Skin.*

In both sexes, it is much thicker in the middle than laterally; in the adult man it is shaded, throughout the whole extent of the median excavation, with hairs, the roots of which are surrounded with numerous large follicles; therefore the lupia, the acne punctata, and pustules similar to those which we so frequently observe upon the face, often have their seat before the sternum, whilst they are very rare upon the sides, where the skin does not present the same characters. In women, all things else being equal, the skin is more delicate, smooth and polished and especially much whiter as it extends towards the breasts. As its extensibility is much greater externally than upon the median line, tumours which form beneath it more readily acquire a considerable magnitude in the first direction than in the second.

II. *The Subcutaneous Layer.*

In emaciated subjects it consists of a lamellated and filamentous cellular tissue, and then forms a membrane of considerable thickness and very extensible upon the muscles, where it supplies the place of the aponeurosis; as it passes upon the middle portion it becomes more dense, as it were fibrous, and is blended with the sterno-costal ligaments. We may separate from it a lamina which adheres more particularly to the skin, and in which the adipose vesicles are deposited. This latter sheet is only a continuation of the superficial layer of the neck, thoracic extremities, etc.; in short, it is only a portion of the general fascia superficialis. The disposition of these sheets is such, that externally they split into three layers: the first appertains to the integ-

uments; the second is applied directly upon the muscles, and the third is intermediate; but upon the median line they become blended together, and never, or at least but very seldom, contain fat; and as they also unite the bones very intimately to the skin, it follows that wounds in this situation are very difficult to unite by the first intention, and that, in the operations which we perform upon it, it is necessary to preserve as much of the integuments as possible, if we do not wish to lay the foundation for almost interminable ulcers. It also follows that in infiltrations and obesity, the sternum appears to be much depressed. Further, this cellulo-adipose tissue, in curving under the inferior margin of the pectoralis major muscle, becomes directly continuous with that of the axilla, and thereby favours the passage of morbid fluids from one of these regions to the other.

III. *The Aponcurosis.*

Laterally, from the clavicle to just below the pectoralis major, it consists only of the simple cellular lamina already mentioned, and which is blended before the sternum with the periosteum and the preceding layer. More inferiorly we observe a completely fibrous sheet, which becomes thicker the nearer it approximates the epigastrium. It is arranged in the form of bands, and its fibres run obliquely downwards and inwards, in order to become continuous with the aponeuroses of the belly. It covers the recti muscles in particular, and binds them down upon the ribs.

IV. *The Muscles.*

(a) The *pectoralis major* is the thickest and most powerful of the muscles of this region; as its attachment forms a curved line, the convexity of which looks towards that of the opposite side, the free space which the two pectoral muscles leave between them upon the sternum, is broader superiorly, and especially inferiorly, than in the middle; this disposition is very distinctly delineated through the skin in strong muscular individuals. This muscle is separated from the skin by the thickest part of the subcutaneous layer, and generally admits of a communication between the superficial cellular tissue and the deep adipo-cellular

layer, through the groove which separates its clavicular and sternal portions. This communication accounts for the transportation of inflammation, pus, etc., although primitively developed or formed under the skin of the sternal region, into the hollow of the axilla.

(b) The *rectus abdominis* comes next. This muscle is generally very thin here, and is commonly intersected externally by the last digitation of the preceding; it is sometimes inserted into the side of the base of the xiphoid cartilage, and always upon the seventh and eighth ribs, so that it might more properly be called costo-pubic than sterno-pubic. Its fibres are parallel and descend perpendicularly; and where they abandon the ribs in order to enter the epigastrium, they are usually crossed transversely by a fibrous intersection, which adheres firmly to the aponeurosis, and is much more complete before than behind, where it even does not exist at all.

It is not uncommon to see the superior extremity of this muscle, either in whole or in part, pass much higher, ascending sometimes even to the origin of the sterno-mastoid, and thereby bearing a resemblance to the natural disposition of several mammi-ferræ. At other times, the anomaly is independent of this muscle, and some supernumerary bundles have been seen upon different parts of this region. Thus, there is sometimes a small distinct muscle which descends from the superior extremity of the sternum, where it is simply inserted into the bone, or is continued with the sterno-mastoideus towards one of the sterno-costal cartilages, binding down the pectoralis major muscle; at other times, it is merely a fascis detached from the *sterno-lumeral* (pectoralis major), sterno-mastoid or *sterno-pubic* (rectus) muscles, etc. In all which cases, these anomalous muscles may elevate the skin so as form reliefs, which we should guard against mistaking for pathological swellings.

(c) A small portion of the *obliquus externus abdominis* (*costo-abdominal*), is found in the inferior part and upon the external limits of this region, between the rectus, pectoralis major, and serratus magnus muscles, with which it digitates.

(d) All these muscles are applied directly upon the bones or cartilages; but the spaces between the latter are also filled by the anterior third of the *intercostales interni*, the fibres of which,

directed downwards and inwards, are a mixture of fleshy bundles and aponeurotic bands; they are separated from the preceding by a cellular layer, which becomes more distinct as it removes from the median line.

(e) Deeply seated, behind the skeleton, between the cartilages and pleura, we find the *triangularis sterni* muscle, which seems to be continuous externally with the internal intercostals, and which performs an important part in the fractures of the bones to which it is attached. Finally, quite inferiorly, the anterior portion of the *obliquus internus*, (*ilio-abdominal*) muscle, and of the *diaphragm*, also attach themselves to the inferior border of the solid portion of this region.

v. *The Arteries.*

These vessels appertain to three orders: they originate from the axillary and subclavian arteries, and from the thoracic aorta.

The first are generally small ramuscules, which are derived from the branches of the anterior thoracic, acromial and external mammary arteries. They are lost in the skin, superficial cellular layer, pectoralis major, and the deep lamellated layer, anastomosing with the external branches of the internal mammary (*sub-sternal*) artery.

The *internal mammary* appertains to the second order, and is the most important artery of this region. It originates from the subclavian opposite to the vertebral artery, descends, directing itself forwards, behind the cartilage of the first rib, or some lines external to the sterno-clavicular articulation, and thus continues its course, gradually diminishing in volume, as far as the sixth intercostal space. It is only separated from the cavity of the thorax by the pleura covered by a cellular layer, and by the *triangularis sterni* muscle; its anterior surface is in close contact with the cartilages which it crosses, and is only removed from the internal intercostal muscles by a cellulo-adipose layer, which is usually very thin. It lies about three lines from the outer edge of the sternum; so that, superiorly, its ligature, which has been proposed by some surgeons, would in fact be possible, provided circumstances presented themselves actually requiring the performance of this operation. In order to discover it, it would be suf-

ficient to make an incision two or three inches long through the skin, parallel to the margin of the sternum, and by preference upon the third intercostal space, because it is the widest ; then, we would have to divide the superficial cellular layer, the fibres of the pectoralis major muscle, a thin lamellated tissue which separates it from the intercostal, the most internal fibres of the latter, finally a cellular layer of slight thickness, when the artery will be exposed. From the position and calibre of this vessel, we see that the thrust of a sword, or of any pointed instrument whatsoever, would produce a hæmorrhage in the sternal region, especially if it passed near the sides of the sternum, and that the higher the wound, the greater would be the danger from the hæmorrhage.

The principal branches given off from the internal mammary are the anterior and the external ; the former traverse the intercostal muscles near their internal extremity, in order to reach the subcutaneous layer, where they inosculate with twigs from the axillary artery. In females, one of these branches is sometimes of considerable size : it is that which ramifies in the mammary gland. The external branches pass outwards and complete the intercostal arches. These arteries increase in volume the lower they are given off. Finally, the trunk itself, which bifurcates near the cartilago ensiformis, and one of its divisions immediately gives off a large twig which passes before this appendix, in order to form an arch with a similar twig from the opposite side. This arch is sometimes so large that its pulsations may be distinguished through the skin, and may occasion hæmorrhage in consequence of wounds received in the lower part of the sternal region.

VI. *The Veins.*

We frequently find two for each internal mammary artery, and always one for each of the other arterial canals. These vessels are not very important in a surgical point of view ; except it is that the superficial ones sometimes dilate in such a manner as to form varicose cords under the skin, as we observe, for example, in females affected with scirrhus or cancer of the breast ; in those also who have nursed several children, or who from a state of obesity, have fallen into marasmus : finally, in persons whose

venous circulation of the superior systems has for a long time been impeded by an organic lesion of the thoracic viscera. To the subcutaneous veins are also to be attributed those peculiar streaks (*vergetures*) which the skin upon the anterior part of the chest presents in certain individuals.

VII. *The Lymphatics.*

They are pretty numerous towards the axillary and costal regions, and much more so in women than in men. Those which are situated upon the fore part of the pectoralis major muscle ascend to the glands of the neck; hence diseased enlargements of the latter organs, when the breasts are affected with cancer. Those of the deep series pass directly to the axilla, and also communicate with the lymphatics of the thoracic cavity. Sometimes there is a gland in the furrow which separates the inferior border of the pectoralis major from the other parts, in which case this body is situated upon the largest bundle of vessels which go from the sternal region into the axillary cavity.

The lymphatic system is here disposed in such a manner, that blisters, issues, as well as all chronic diseases with alteration of tissue, rarely persist beyond many months upon the anterior part of the thorax, without re-acting sympathetically upon the glands in the sub-clavicular hollow.

VIII. *The Nerves.*

The extreme branches of the intercostal nerves are the only ones which we observe in the inferior fourth of this region; superiorly, it derives numerous filaments from the axillary plexus, and from the supra-clavicular branches of the cervical plexus. All these nerves are of small volume, and cannot be of moment in operations. But it is proper to observe that all those which come from the brachial plexus and intercostal branches appear to be more particularly distributed to the muscles, whilst the cervical twigs seem rather to appertain to the skin. Prof. Laënnec thinks that *angina pectoris* is frequently nothing more than a neuralgia of the latter. We do not know upon what data this celebrated physician founds his opinion; but we believe that what has been described by Rougnon, Heberden, and many English and French

physicians, under the name of *Angor* or *Angina Pectoris*, is a disease which affects organs of higher importance than those under consideration.

IX. *The Skeleton.*

It is formed by the whole of the sternum, the sterno-costal cartilages, and the sternal extremity of the clavicle. We will consider each of these parts separately.

It is here especially that we must examine the sterno-clavicular articulation. The osseous surfaces are so arranged in this joint that the clavicular extremity is, as it were, merely applied upon the sternal facet; but to make amends for this, these two bones are fixed by means of strong and very short ligaments, and the nature of the movements which the clavicle must execute, prevent it from being so often luxated as might at first sight be imagined. Thus, the clavicle being fixed to the sternum by a species of capsule which is very strong superiorly, and, on the other hand, attached to the supra-sternal notch, and to its similar bone of the opposite side, it will oppose very great resistance before it escapes from the cavity which contains it in this direction. It is true, that when it is descending, it acts upon the first rib as a lever of the first order; but the disposition of the shoulder in general, and of the scapula in particular, will almost constantly prevent this movement from being carried so far as to effect the rupture of the ligaments. The luxation of the clavicle directly upwards, therefore, is very difficult, if not quite impossible. Posteriorly, this bone makes a prominence in the summit of the thorax, and, on the right side, corresponds to the termination of the left subclavian vein, and to the arteria innominata, from which it is separated by the origins of the sterno-thyroideus and sterno-hyoideus muscles; on the left side to the same vein, and to the interval which separates the left subclavian and carotid arteries. This prominence is owing, on the one part, to the head of the bone representing a species of triangle, the apex of which is inclined backwards and downwards; on the other, to the great convexity which the clavicle presents anteriorly, whereby it is naturally thrown back a little in the opposite direction, when it arrives at the sternum. Notwithstanding these unfavour-

able dispositions, posterior luxations of this bone are extremely rare ; and the reason of it is found in the strength of the fibrous capsule, of the costo-clavicular ligament, and the position of the scapula, which does not permit the transverse lever of the shoulder to advance sufficiently forwards to produce the luxation. Inferiorly, the two bones being in contact, every species of displacement is impossible ; but it is not so anteriorly. In fact, on this side, the articulation is only supported by the sternal tendon of the sterno-mastoideus muscle, which is also, most frequently, too much approximated to the median line ; and by the anterior ligament, or capsule, which is weaker than in the other directions. Besides, nothing limits the movements of the clavicle backwards, and the anterior surface of the shoulder presents itself much more advantageously to external powers than the posterior, in order to produce this movement : there is nothing surprising then in the luxation forwards being the most frequent, and almost only possible one.

The sternum is about eight lines in thickness, which thickness is more considerable opposite to the cartilages than to their intervals, and still greater in the clavicular portion of the bone (*manubrium*). In childhood it consists of different pieces, which sometimes preserve their mobility in the adult age, especially the first two. It is proper to recollect these peculiarities, as they might sometimes be mistaken for fractures. Occasionally also the *primi-sternal* and the *duo-sternal*, in uniting, leave a hole which is only filled by a fibrous or fibro-cellular tissue, and which might induce the belief that the operation of trephining had been performed ; this foramen might also permit instruments to penetrate more easily into the chest, and thus render wounds in this situation more serious : at other times the lateral points of ossification do not coalesce upon the median line ; the sternum then remains bifid in its inferior fourth, third, and even half, and nothing would then be more easy than to wound the central organs of the thorax, through a similar division. The xiphoid appendix sometimes projects outwards, and stretches the skin so much, in thin subjects, as to occasion its ulceration ; neither is it more uncommon to see it curved backwards ; and as it corresponds to the stomach, it might impair the digestive functions, and occasion symptoms similar to those which characterise gastralgia. It is also

well to know that this cartilage may incline to the right, to the left, and in all possible directions; that sometimes it is blunt, at others acute, and again bifid, even when the sternum is well formed. In general, the form of the region under examination is determined by that of the sternum, and it is of importance to note this form, on account of the influence which it exercises upon the functions of the heart and lungs. Thus, when this bone is very protuberant, as is the case in the natural state in children, the movements of the heart are very free; but the lungs are pressed against the sides of the pericardium; when on the contrary it is convex backwards, the circulatory organs are compressed, as it were, upon the spine, whilst those of respiration distend freely on each side.

As the upper and right portion of the sternum is very near to the *arteria innominata*, (*brachio-cephalic trunk*), some have supposed that, by trepanning this bone immediately below and within the clavicle, we would easily reach the artery; but this operation, though not very difficult upon the dead body, must, in our opinion, be of very difficult performance upon the living subject.

M. Laënnec has also advised the application of the crown of the trephine upon the left inferior third of the sternum, with the intention of opening the fibrous envelope of the heart in cases of *hydrops pericardii*: then, it would be necessary to recollect that this bone is thinner inferiorly than in its superior portion. Although the sternum is destined to protect organs of the first importance, it may be diseased, in great part disorganised, and even destroyed, without the life of the individual being thereby truly endangered. The case related by Galen, and since so frequently repeated; that mentioned by Harvey, in which the bone was perforated in such a manner that the heart was, as it were uncovered, are incontestable proofs of it; so that if blood, pus, or any other fluid was accumulated in the anterior mediastinal space, and the evacuation of the morbid product might save the patient, we should without apprehension apply the trephine here. Besides, the bone is so soft and spongy, in the greater proportion of adults, that it would be easy to perforate it, even with the knife. This softness, which is owing to its great vascularity, also accounts for the frequency of its diseases, and for its being less subject to necrosis than caries. As the sternum is susceptible of

elevation and depression during respiration, and is suspended, as it were, by the extremity of flexible cartilages; as it is likewise flexible itself to a certain extent, its fractures must be very difficult to produce, and even seem impossible unless by a direct cause; in fact, we can scarcely conceive it possible for it to be acted upon by two different powers which would tend to approximate its extremities towards each other. There is, however, an example of fracture by counter stroke, related by David, and registered in the *Mem. de l'académie royale de chirurgie*, in which we see that a man fell from a great height upon the ensiforme cartilage and fractured the sternum through its middle. In these fractures, by whatever cause they may have been produced, the internal derangements, consequent upon them, must occupy more of the surgeon's attention than the lesion of the bone: it is possible, however, that one of the fragments may be displaced backwards; in which case it would not fail to occasion serious disturbance of the heart or principal vascular trunks. Finally, on account of its spongy nature, its great vitality, and its being interposed between two fibrous layers of a certain thickness, the sternum is very promptly consolidated; but, in order that this consolidation may take place, it is necessary that the fragments should be retained immoveable, which is easily done, by obliging the respiration to be performed solely by the diaphragm.

The sterno-costal cartilages, elastic and flexible, uniting the first seven ribs to the sternum, and applying the last five to each other by the anterior extremities of their inferior border, are so disposed that the first is the shortest, broadest, strongest and the most firmly united to the two bones which it connects; and it is this last circumstance especially which prevents the first rib from being more moveable than the following ones, and which supports the clavicle. In examining the others in succession, we find that their length and mobility increase as far as the seventh inclusively; although the last five gradually diminish in length, they are still more moveable, because their union only takes place by means of facets which admit of a more or less extensive sliding motion (*glissement*), and because they are also much thinner: whence it follows that they are very seldom fractured, whilst the former are pretty frequently broken. But whether

these fractures are produced by direct or indirect causes, if the fragments are susceptible of crossing each other, the displacement will almost always take place in such a manner that the sternal will pass before the costal portion; and for this reason, because the pectoralis major muscle acts with more or less force upon the former, whilst the triangularis sterni tends to draw back the latter. The fracture is always transversal, and the nature of the cartilage singularly modifies here the disposition of the callus. In fact, although Autenrieth has stated that the costal cartilages reunite after their fracture, MM. Magendie, Lobstein, Béclard, etc., have observed that the two fragments do not become agglutinated, and that their perichondrium alone experiences a transformation, or such changes, that it at length forms an osseous hollow cylinder, in the centre of which the two cartilaginous extremities are encased; in short, that the restorative efforts of nature are limited to what Duhamel, Fougereux, M. Pelletan Senr. etc. have described as the principal phenomenon of reunion, in fractures in general, or rather to what M. Dupuytren calls the *provisory callus* in the long bones; that is to say, that this union is effected entirely at the expense of the fibrous envelope. It is necessary to note, however, that these cartilages frequently become ossified as age progresses, and that the same sometimes occurs in certain diseases of the chest, in phthisis, for example; then their fractures must take place more readily and the callus form as in the long bones. On the other hand, their cartilaginous state has been found to persist in persons who have prolonged their existence to a very advanced period; to one hundred and thirty years, (Kiel,) and even to one hundred and fifty, (Harvey).

The first three inter-cartilaginous spaces are broader than those which follow them; the sixth is already very much contracted, and this is one reason why we should choose the fifth, if we wished to open the pericardium, according to the method undertaken by Desault. In this point, we would not be obliged to divide the pectoralis major; the rectus muscle is here very thin, and frequently does not ascend so high; the pericardium also is nearer to this space than any other, and the internal mammary artery bifurcates lower down. Consequently, we would have to divide the skin, the superficial layer in some subjects, some fibres of the pectoralis major muscle, or the aponeurosis, a second cellular

layer thinner than the first, the internal intercostal muscle, additional cellular laminæ, the pleura, finally the pericardium, taking care to leave the internal mammary artery on the inner side, and to avoid the anterior margin of the lung, which must be pushed outwards. It is needless to say that we are speaking of the left side.

From what has preceded, we see that wounds upon the median line, in the sternal region, would fall directly upon the heart or large vessels, whilst upon the sides they would also encounter the lungs. We will see, when examining the internal organs, the dangers of their lesions, according to the points upon which they are inflicted. We will only observe, by anticipation, that penetrating wounds made by pointed or cutting instruments, will be more dangerous when they simply pass through the thoracic parietes in the inferior intercostal spaces and near the sternum, than at the superior part, on account of the internal mammary and its branches.

We will further remark that a transverse wound, before and upon the sides of the supra-sternal notch, might produce two kinds of accidents: one, relative to the sterno-clavicular articulation, which would then be easily opened, and the other to the division of the sterno-mastoid muscle. The sternal portion of this muscle, in fact, descends so low in some persons, that it might possibly be divided upon the fore part of the sternum, and as it is this muscular portion which supports the upper part of the chest in full inspirations, great exertions, etc., serious changes in the exercise of these phenomena would result from it.

All these parts are, besides, arranged in the following order; 1st, the skin, thick and compact in the sternal gutter, supple and extensible upon the lateral parts; 2d, the subcutaneous layer, divisible into three laminæ before the pectoralis major muscle, where it is sometimes very thick, fibrous upon the median line, and in which arterial twigs, nervous filaments and veins more or less voluminous, ramify; 3d, the aponeurosis, distinct in the inferior fourth of the region only; 4th, the pectoralis major muscle, a small portion of the rectus abdominis, a very small part of the tendons of the sterno-mastoideus; it is in this stratum that we find the principal arteries and the deep nerves; 5th, the sternum, cartilages, intercostal muscles; 6th, a lamellated layer, the inter-

nal mammary artery ; 7th, the triangularis sterni muscle and the pleura.

Sect. 2. Posterior Region.

This portion of the thorax is bounded superiorly by the posterior region of the neck ; inferiorly, by a curved line similar to that which limits the sternal region below, that is to say by a line which runs along the inferior margin of the twelfth ribs, in order to pass upon the spinous process of the twelfth dorsal vertebra ; laterally, by a line which arbitrarily prolongs the vertebral border of the scapula upon the union of the posterior third of the crista of the ilium with its two anterior thirds, and which would consequently follow the prominence formed by the angles of the ribs : we will call this the *scapulo-coxal line*.

Upon the surface of this region, in the inter-scapular portion and upon the median line, we observe a ridge, in general not very prominent, and which is produced by the vertebral spinous processes ; upon the sides of this ridge, two grooves or gutters, varying in depth in different subjects ; more externally, two eminences which correspond to the muscular masses, and which become more prominent in proportion as the shoulder is carried forwards ; finally, the posterior margin of the scapula, which changes its position during each movement of the superior extremity, and which is also more or less prominent according to the conformation of the thorax.

In the inferior part of the region, the median ridge is pretty frequently very prominent, the lateral grooves are also much deeper and the muscular eminences larger than in the superior portion. This difference arises from the spine being very convex above, whilst below it is inclined in the opposite direction ; from the spinous processes being very oblique superiorly, and horizontal inferiorly. As the lateral convexities depend as much upon the curvature of the ribs as upon the prominence formed by the muscles, we will always increase them by carrying the arms forwards, so as to cross them upon the fore part of the chest, or over the head, for example ; which it is necessary to do, when we endeavor to ascertain the state of the lungs, or of the other thoracic viscera, by percussion or auscultation.

CONSTITUENT PARTS.

I. *The Skin.*

It is thicker than that of the posterior part of the neck, but does not otherwise differ from it, except in its slighter adhesion to the muscles and its firmer union to the spinous processes of the vertebræ. It contains a great number of sebaceous follicles, but is destitute of hairs and wrinkles; it is very dense and its sensibility very great, although it does not receive many nerves; the acute pains which are manifest in it, when it becomes the seat of boils, carbuncles, erysipelatous or other inflammations, evidently depend upon these two circumstances, and by the latter we can account for the numerous and extensive sympathies which its artificial or natural irritations bring into action. Thus, every body knows, that an epistaxis is frequently and immediately arrested by applying a key, or any cold metallic body, as well as linen steeped in refrigerant liquids, etc., between the shoulders. It is also founded upon these results that we have applied upon this part, and with immediate success, cataplasms of mustard, in cases of uterine hæmorrhages occurring immediately after parturition, or at the expiration of a few days, which had resisted other rational means, and threatened to become speedily mortal.

II. *The Subcutaneous Layer.*

Divisible into several laminæ by maceration, it is compact, dense, and forms a complete fascia superficialis. This layer is composed of a lamellated and filamentous cellular tissue, in which are soft, reddish and elongated adipose cells, capable of considerable enlargement, and of forming a fatty stratum of a certain thickness in persons who have much *embonpoint*. It is not unusual to see some of them agglomerate, and thus enlarge together so as to produce lipomatous tumours, which sometimes become of a considerable volume. But this pathological developement of the fatty vesicles can only take place upon the sides, because, upon the median line, the cellular layer, under consideration,

unites the vertebræ intimately to the skin; and it is also for this reason, that infiltrations, abscesses, collections, and tumours of every kind, with the exception of those which depend upon diseases of the bones, never manifest themselves in the middle of the dorsal region.

This layer may inflame and suppurate; but, as it is interposed between two planes which offer much resistance, purulent abscesses form in it very slowly, extend in breadth, and sometimes persist a long time before they project externally; the skin which covers them may preserve its thickness and the greater part of its other characters during several months. If the inflammatory phenomena are not very acute, the collection will be called a chronic abscess, or be mistaken for a purulent deposition (*dépot par congestion*), and finally produce the death of the patient. As these abscesses are limited anteriorly by the thickened aponeurosis, they may burrow extensively, even from the posterior part of the neck into the lumbar region. It seems evident to us, that, in cases of this nature, the danger proceeds from the resistance of the tissues, which oppose the evacuation of the diseased secretions, and that the best means of saving the patients, would be to open early and freely the cavities in which they are contained.

3. *The Aponeurosis.*

In some places it is composed of thin cellular laminæ of but slight strength; in others, it is thick and strong. Thus, the anterior and posterior surfaces of the trapezius and latissimus dorsi are covered by a thin and extensible sheet, which adheres to them firmly, the layers of which are applied together and blended near the inferior angle of the scapula, in the small triangular space which separates these two muscles, so as to form a more distinct lamina. Another aponeurotic sheet binds down the muscles of the vertebral gutters, and is prolonged upon the splenius to the neck, splitting in order to envelope the serratus posticus superior, confounded below, upon the serratus posticus inferior, with the aponeurosis of the lumbar region, and inserted into the spinous processes of the dorsal vertebræ on the one hand, and upon the angles of the ribs on the other. In other words, the very strong aponeurosis of the latissimus dorsi may be con-

sidered as furnishing envelopes to all the muscles of the back, and especially a very regular sheet, which serves to separate the muscles which form the superficial stratum from those of the deep stratum. These different sheets are too thin, and do not sufficiently assume the aponeurotic characters to become the causes of serious accidents in deep-seated inflammations of the back; but, in becoming blended, as it were, with the superficial muscles, they form a strong layer, which prevents the abscesses, indicated in the preceding paragraph, from penetrating under the shoulder, etc.

IV. *The Muscles.*

Those which form the superficial stratum are flat and of greater or less breadth; the deeper seated are long and collected into a mass.

The former comprise,

(*a*) The inferior half of the *trapezii*, which here represents a triangle, the apex of which is situated upon the last dorsal vertebra, whilst the two angles of its base terminate upon the spine of the scapula; so that, in order to render these muscles tense, it is necessary to carry the arms more or less forwards; and the principal effect of their contractions must be to raise the shoulders, at the same time that they approximate the two scapulæ to the chest and spine. The trapezius is covered by a fibro-cellular lamina which appertains to the aponeurosis, by the subcutaneous layer and by the skin; it is separated from the deep stratum by the *rhomboidei*, *latissimus dorsi*, and some lamellæ of cellular tissue.

(*b*) A considerable portion of the *latissimus dorsi*, and especially of its aponeurotic origin, since it ascends to the fifth vertebra of this region; its fibres are transverse or slightly oblique, and derive their fixed point from this region. This muscle is covered by the trapezius, the superficial layer and the skin, and is pretty firmly united to the *serratus posticus inferior*; but it adheres to the deep aponeurosis only by means of some soft, and extensible cellular lamellæ. When it emerges from under the trapezius, near the angle of the scapula, it forms the inferior border of the small triangular space mentioned when on the

posterior region of the shoulder, and through which an instrument might penetrate into the cavity of the axilla, without dividing any other muscles than the serratus magnus. It is also through this kind of aperture, that pus or other fluids might pass from the dorsal region into the summit of the lateral region, between the side of the thorax and the serratus magnus muscle, ascend into the supra-clavicular region, or descend into the costal region, or finally pass from all these regions into that which we are now considering. Since the use of the latissimus dorsi muscle is to draw down the arm and carry the inferior angle of the scapula backwards, it is necessary, in order to make it tense, and render the portion of the back which it covers more prominent, when we wish to exercise percussion or apply the stethoscope to this part of the chest, to cross the superior extremities over the crown of the head.

(c) The whole of the *rhomboideus major*, (rhomboïde dorsal,) as well as a small part of the *rhomboideus minor* (rhomboïde cervical) muscles. They are separated from the trapezius by a thin layer of cellular tissue, and conceal the serratus posticus superior; their distance from the angle of the ribs varies according to the position of the shoulder, and the intervening space is filled with supple and very lax cellular lamellæ, in which adipose vesicles are seldom met with. This space is prolonged between the costal portion of the axilla and the serratus magnus muscle, which separates it from the cavity of the axilla; it communicates directly with the supra-clavicular region; and, as the cellular tissue which fills it is very extensible and very soft, it follows that fluids, accumulated in the lateral part of the neck, soon descend between the ribs, the rhomboidei and the serratus anticus. As the rhomboideus major muscle originates from the spinous processes of the back, and is inserted into the vertebral border of the scapula by means of an arched aponeurotic cord, it can only act upon the shoulder, which it draws backwards towards the median line and upwards, if it contracts alone, or directly backwards when it acts in concert with the trapezius.

(d) The *serrati postici*. The superior passes obliquely downwards from the first dorsal spines to the external part of the angle of the three ribs which follow the first; the inferior, from the spinous processes of the first three lumbar and last two dorsal

vertebræ to the posterior part of the twelfth, eleventh, tenth, and ninth ribs; so that their common action is to pull the osseous arches of the thorax backwards and outwards, and that the first raises these bones, whilst the second draws them down. Consequently, when the ribs are fractured through their middle, they must tend to displace the posterior fragment outwards and downwards, or outwards and upwards, according to the situation in which the solution of continuity exists.

The latter, or the deep-seated muscles, are less important in a surgical point of view than the preceding; they fill the vertebral gutters, and comprise the dorsal portion of the interspinales dorsi et lumborum, of the sacro-lumbalis, of the longissimus dorsi, of the semi-spinalis dorsi and multifidus spinæ, and besides the origins of the complexus, splenius and transversalis colli. All these muscles are separated from the superficial layer by the aponeurosis of the serrati postici; they can only act upon the spine and the posterior extremity of the ribs. The external tendons of the longissimus dorsi are inserted near the angle of these bones, and the chest is dilated during their contraction, which also favours expiration. The levatores-costarum muscles are partly covered by the latter, and descend obliquely outwards from the external part of one costo-transverse articulation to the rib which is below it, being prolonged upon the second also. They are entirely included in the dorsal region, and are continuous below with the external intercostal muscles. Their use is to elevate the ribs, as was well observed by Verheyen and Steno. In fractures, they act in the same manner as the serratus posticus superior, and counterbalance the action of the inferior, and of the external bundles of the longissimus dorsi. With respect to the intercostals, they present nothing particular in this region, and we only find in it the origins of the external.

v. *The Arteries.*

There are none so large, with the exception of the intercostals, as to occasion a profuse hæmorrhage in wounds of this region. One of the branches of the descending cervical, originating from the subclavian, ramifies before the rhomboideus muscle, and is generally distributed to the superficial muscular

layer, previous to anastomosing, in the latissimus dorsi muscle, with the subscapular artery, and in this manner forming an arterial arch which unites the subclavian to the brachial. Each intercostal artery here gives off its posterior branch, which passes between the bodies of the vertebræ, the inferior costo-transversal ligament, and two transverse processes, in order to enter between the sacro-lumbalis and inter-spinales dorsi muscles, where it afterwards divides. Then one of the branches approximates the median line, as it passes towards the skin; the other, on the contrary, removes from it, and penetrates between the sacro-lumbalis and longissimus dorsi muscles, in its course towards the superficial layer and skin, where it terminates: finally, the intercostal artery itself, included in the space of the same name, passes through this region, and in such a manner that it does not actually enter its protecting groove in the rib, until it has arrived near the angle of this bone: it is yet so remote from it, opposite to the apex of the transverse process, that an instrument penetrating through the intercostal space might easily strike it. But, let us admire here, as in a multitude of other points, the disposition of parts; in fact, the thick muscular mass which protects this vessel posteriorly against the action of foreign bodies, becomes thinner and thinner in proportion as it passes outwards; but then the artery, which was at first free below the rib, afterwards approximates so close to it, that it is almost entirely situated under its internal surface. In general, the nerve which accompanies it runs along its inferior border, and frequently it gives off its descending branch before it enters into the costal region.

VI. *The Veins.*

These vessels have the same distribution as the arteries: they all pass to the azygos veins through the medium of the intercostals, and into those of the arm and neck by the cervical and subscapular veins.

VII. *The Lymphatics.*

They are very few in number, and merit still less attention

than the veins. Those of the deep stratum, for the most part, enter into the axillary glands; almost all of the superficial, into the supra-clavicular region: hence, from this disposition, diseases of the skin and of the cellulo-adipose layer must re-act more particularly upon the lymphatic glands of the neck, whilst affections of the deep-seated parts will produce tumefaction of those in the cavity of the axilla.

VIII. *The Nerves.*

Besides the spinal accessory, which is lost in the trapezius muscle, some filaments of the deep branches of the cervical plexus, which extend as far as the rhomboideus major and serratus posticus inferior, and some others derived from the brachial plexus, the dorsal region also receives the posterior branches of the spinal nerves. These last follow the arteries, divide in the same manner, and ramify in the superficial layer and the skin. The intercostal nerve, inferior to the artery, equally places itself under the margin of the rib, and sometimes divides before it abandons the dorsal portion of the thorax.

IX. *The Skeleton.*

It is composed of the twelve dorsal vertebræ and of the ribs, as far as the angle or posterior curvature of the latter. The former are so arranged that their body, which is more extensive in the antero-posterior direction than transversely, forms a species of column which is concave anteriorly, and which advances in the thorax. This anterior concavity, which is owing to the vertebræ and the intervertebral fibro-cartilages possessing a greater degree of thickness behind than before, presents almost infinite gradations. In new-born children, it scarcely exists; in old people, it is generally very much developed; much slighter in woman than in man, in persons who habitually keep themselves erect than in those who bend over their work, it may increase considerably, or totally disappear in consequence of rachitis. In the first case, a gibbosity is produced, and the sternal region is then more or less depressed; in the second, the dorsal region appears very much excavated, and the sternum projects more or less

forwards. Another curvature is observed upon the left side and in the superior third of the column, at the place upon which the aorta rests in the chest. This last concavity varies less than the preceding in a well-formed subject; but in rachitis it perhaps more frequently passes beyond its natural limits, and concurs very much in the production of gibbosity. The formation of these curvatures, moreover, is very easily accounted for, and upon mechanical principles; it is owing to the weight of the body and the action of the muscles. Thus, as the head preponderates forwards instead of backwards, the posterior muscles, in order to maintain the equilibrium, are kept in a state of almost permanent contraction, and cannot fail to make the cervical portion of the vertebral column project forwards. The weight of the viscera of the thorax, on the one part; that of the head and neck on the other, tend to pull the upper part of the chest forwards; but as the line of gravity would not fail to pass beyond the base of support, in order to prevent the fall and counter-balance the anterior effort, the sacro-lumbalis and longissimus dorsi muscles pull forcibly upon the two inferior thirds of the dorsal portion of the spine, and thus produce the convexity which is observed in the upper part of this region. In the most common actions of life, most people use the right arm much more frequently than they do the left; as in raising burdens, etc. Then, at the same time that several muscles of the right shoulder draw the corresponding portion of the vertebral column to this side, those of the opposite side, which fill the spinal gutters, tend to approximate the cervical to the last dorsal vertebræ, in order to keep the central line of the body in a proper position; and hence that lateral curvature which, previous to Bichat and Béclard, was attributed to the position of the arch of the aorta. Let us now apply this mechanism to rachitic curvatures, and we will readily comprehend in what directions they must most frequently be inclined, and we will better understand the utility and importance of orthopedic means in these deformities, when there is no disorganization present.

In these deviations, the spinal canal becomes flattened, but not actually diminished; hence they may be carried to an extreme degree without compressing the medulla spinalis; whilst in Pott's disease, or the gibbosity which depends upon caries of one or

more vertebræ, paralysis generally soon manifests itself. In the latter case, in fact, the caries seldom advances so far as to admit of the sinking in of those which are above and below, without equally affecting the nervous cord, which is also occasionally compressed in the deformed canal in which it is lodged. We should remark that, in Pott's disease, the curvature is more acute and almost always posterior, whilst that which arises from softness of the bones is more elongated, and frequently lateral.

The spinous process of the dorsal vertebræ, almost horizontal at first, are inclined and very much imbricated in the middle, and again become horizontal in the lower part of the back; so that superiorly and inferiorly, the movements of extension may be carried pretty far; whilst in the middle portion, they must be extremely limited. The plates (*laminae*) are short, very thick and overlap each other, so as to render it almost impossible for instruments to penetrate into the vertebral canal. The articular facets, which are very oblique and almost perpendicular, even below, are so disposed that the inferior, placed behind the superior, look forwards and outwards, and very powerfully resist luxations without fracture, but nevertheless admit of distinct flexion, whilst they oppose the movement of extension. The transverse processes are remarkable for their thickness, their length, and especially for their inclination backwards; which disposition increases the depth of the vertebral gutters externally, and of the thoracic excavations within the chest. The spinal canal is narrow, almost cylindrical. The medulla spinalis here sends off nerves to the thoracic and abdominal parietes, to the inferior extremities, and one branch only of the brachial plexus; so that a wound of this cord, between the second and third dorsal vertebræ, would not paralyze the superior extremities, and that, in order to suspend the nervous action in the inferior, it would be necessary for the lesion to take place towards the seventh or eighth, because the roots of the nerves pass towards the *holes of conjunction* (*trous de conjugaison*) by following a line which is more oblique in proportion as they are more inferior. The researches of modern physiologists have demonstrated, that, by destroying the spinal marrow in the dorsal region, the movements of the heart would be suspended, on account of the roots of the great sympathetic, at the same time that it would pro-

duce paralysis; but we have related facts* which tend to prove that these laws are liable to some exceptions. Some appropriate experiments performed by Shaw, Ch. Bell, M. Magendie, Bécлар, M. Descot; certain observations on pathological anatomy related by several authors, and those which we have recorded in the *Archives générales de Médecine*, tend to prove that the posterior columns of the spinal marrow preside over sensibility, whilst the anterior appertain to motion: it is evident then, that one or the other of these two faculties of relation will be impaired the first, according as the wound or disease shall have primitively existed either anteriorly or posteriorly, in the dorsal and cervical portions of the spinal column.

From the strength of the super-spinal, interspinal, yellow, pre-vertebral and posterior vertebral ligaments, and especially that of the intervertebral fibro-cartilage, together with the disposition of the osseous surfaces, luxations of the dorsal vertebræ must be almost impossible; for the same reason, their fractures are both very difficult and very unfrequent, and also because the soft parts and ribs deaden the force of external powers which might act directly upon the vertebræ.

The curvature of the ribs is also very great here, but it varies according to age and in different individuals. In children it is proportionately much less than in adults: therefore in the first years of life the chest appears compressed laterally, whilst it is more prominent anteriorly and posteriorly. When this disposition persists in the adult, the scapulæ usually project more behind, constituting what is called the "*chicken breast*": in this case the ribs appear to be less curved under the shoulders, whereby the lungs must be pushed forwards, so that it has been supposed that this conformation predisposed to tubercular phthisis: a circumstance which would favour the idea that this disease is in a measure caused by irritation and inflammation.

As the ribs are applied upon the whole extent of the anterior surface of the transverse processes, we do not conceive that their posterior extremity can be luxated, notwithstanding the assertion of Buttet in the *Mémoires de l'académie royale de chirurgie*. If they were driven with sufficient force from before

* Archives générales de Médecine Janvier et Fevrier 1825.

backwards, they would be fractured towards their angle before the costo-vertebral and inter-transverse ligaments could be broken. If the force acted behind, the strength of the costo-transverse ligament and the manner in which the head of the rib is supported upon the bodies of the vertebræ, would also render its fracture more easy than its luxation. Finally, we do not know of an authentic example of this form of displacement, and that related by Buttet is not of such a nature to produce conviction.

The intercostal spaces are narrow in the dorsal region, and the more so as we approximate the vertebræ. Even if there was no other reason to prevent it, we should never perform the operation for empyema in the dorsal region. But there are other motives which should deter the surgeon from it: first, because the operation would be rendered difficult by the thickness of the soft parts which it would be necessary to traverse; and, in the second place, because the intercostal artery and nerves there present their greatest volume, and, not being sheltered by the rib, would render it very dangerous. As all the ribs are not supported by the sternum; as the last five are but loosely united to each other anteriorly, it follows that the superior are more easily fractured than the inferior. But fractures from a direct cause are uncommon in this region, on account of the thick muscular layer which covers the bones behind; neither are those by *contre-coup* very common, because, notwithstanding the great curvature of the angle, the rib more frequently breaks anteriorly, as it is much thinner in this situation and less firmly supported than posteriorly.

Before concluding, we must note that there is sometimes an additional rib on each side; in which case there are thirteen vertebræ. This anomaly is sometimes observed at the superior, at others, in the inferior part. In the first case, the cervical region loses its last vertebra, the costiforme prolongation of which constitutes the supernumerary rib; in the latter, it is the first lumbar vertebra which undergoes a similar deviation.

If we take up the parts which have just been examined, from the surface towards the interior of the thorax, we will find them arranged in the following order: 1st. the skin; 2d. the subcutaneous layer; 3d. the fibro-cellular sheets, which reunite below,

to form the aponeurosis, and which include the trapezius, latissimus dorsi, rhomboidei, and serrati postici muscles; 4th. the deep-seated muscles; 5th. the vertebrae, ribs, the intercostal muscles, and the arteries and nerves of the same name.

Sect. 3. Costal Region.

The lateral region of the thorax is double, and may be divided into two portions on each side: one superior, which enters into the axillary region, and which has already been examined; the other, inferior, or sub-axillary, which forms the costal region, properly so called. Of the first, which was described in its place, we will only speak in an accessory manner in this section.

The costal region is bounded, superiorly, by a line drawn from the inferior angle of the scapula, along the hollow of the axilla, below the nipples; inferiorly, by another line, carried along the margin of the costal cartilages, and thus uniting the two *scapulo-coxal* and *clavi-coxal lines*; anteriorly by the sternal region, and posteriorly by the dorsal. Upon its surface we observe, above, the prolongation of the two borders of the axilla, and, in their interval, the great excavation which forms the commencement of the cavity of this region. The first prominence supports, anteriorly, a portion of the mammary gland, below which we see a depression, which we would call, with M. Gerdy, the *sub-mammary depression*; the other descends obliquely backwards, and may be distinguished even as far as the last ribs. In strong muscular subjects, we notice, between the two preceding prominences, some digital impressions, which indicate the origins of the serratus anticus. Finally, we perceive by the touch, unless the subjects are very fat, the ribs, intercostal spaces, and the summits of the twelfth and eleventh ribs, when they are free in the muscular parietes.

CONSTITUENT PARTS.

I. *The Skin.*

It is destitute of hairs and wrinkles, but contains a great number of sebaceous follicles, which give it a rugous and uneven aspect. Posteriorly, it is of considerable thickness; anteriorly, it

is more attenuated, and its characters are a mixture of those of the skin of the dorsal, abdominal, and sternal regions. It is less adherent to the subjacent tissues than in the dorsal region, moves readily over them, and is very extensible; therefore, its wounds, with loss of substance, are easily and promptly united. This species of mobility is very serviceable in the operation for empyema or paracentesis thoracis, as we are thereby enabled to prevent the admission of air into this cavity.

II. *The Subcutaneous Layer.*

In emaciated individuals it is thin, yet very distinct and lamellated: sometimes, on the contrary, its thickness is so considerable as to prevent us distinguishing the intercostal spaces through the skin. This layer is prolonged, on the one hand, between the pectoralis major muscle and the ribs; and, on the other, before the latissimus dorsi, in order to penetrate the hollow of the axilla. It encloses arterial and venous twigs, and nervous ramifications. The adipose vesicles which are situated in its external laminae, are generally elongated, reddish, and flattened, in persons who have lost their embonpoint.

III. *The Aponeurosis.*

This fascia is also very thin, and rather cellular than fibrous; at first, it is pretty strongly marked upon the external surface of the obliquus externus muscle, where it is continuous with the aponeuroses of the belly; it ascends, single and attenuated, upon the serratus magnus, as far as the axillary excavation; afterwards, it applies itself, anteriorly and posteriorly, upon the deep surface of the great pectoral and dorsal muscles, in order to envelope their margin and thus pass upon the arm.

IV. *The Muscles.*

There are some which are only applied upon the ribs, and which we must first examine. Anteriorly, we find a small portion of the pectoralis major, when it descends upon the sixth and seventh ribs; posteriorly, the most important part of the latissi-

mus dorsi; this last is disposed in such a manner, that its costal digitations pass almost directly to the inferior angle of the scapula, and that inserted into the humerus, it may depress the arm or elevate the last four ribs; for the same reason, when the latter bones are fractured, it tends to draw the fragment to which it is attached, upwards and outwards; consequently, it is an inspirator, since it may dilate the thorax: therefore, during exertions and in deep inspirations, the arms are raised almost instinctively, seeking to fix themselves in a more or less solid manner upon surrounding bodies. Inferiorly and anteriorly, we meet with the digitations of the external oblique, which originate from the last seven ribs, where they intersect those of the preceding, and especially the digitations of the serratus magnus; all these fleshy tongues cover about an inch and a half of the osseous portion of the ribs; they are oblique forwards, downwards, and inwards. According to their arrangement, the obliquus descendens is one of the most powerful depressors of the ribs, and it cannot draw upwards the pelvis, or stretch the aponeurosis of the abdomen, until the other muscles have previously fixed the thorax. In the space circumscribed by the three preceding muscles, we observe the inferior digitations of the serratus anticus, the direction of which is nearly parallel to that of the ribs. The last of these digitations, in abandoning the scapular angle, leaves between it and the rhomboideus and latissimus dorsi muscles, a space, a kind of opening, mentioned already when on the dorsal region, which leads between the shoulder and the thorax, and which forms a communication between the subcutaneous cellular tissue of the costal region and the deep layers of the supra-clavicular and dorsal regions; a space, finally, through which the pus, which may have formed upon the lateral parts of the neck, might gravitate, and form an abscess in the lower part of the costal region, after having passed under the shoulder. In the last place, we see the trapezius and serratus posticus inferior, the latter placed under the latissimus dorsi, and which cover only a very small portion of the costal region.

The other muscles of the side of the chest are enclosed in the intercostal spaces, and form two planes which intersect each other at almost right angles: the external is oblique downwards and forwards; the internal, on the contrary, descends backwards, and

it is upon this disposition that Hamberger founded his opinion that the former was an expirator and the latter an inspirator ; a cellular layer, in which we sometimes observe adipose vesicles, separates the two, and it is between this layer and the internal intercostal muscle that the artery, veins and nerves of the same name are found ; internally, their fibres may be distinguished through the transparent pleura, which is separated from them by some rare and lamellated cellular tissue, in which adipose clusters are sometimes developed in such a manner as to repel this membrane inwards, and thereby produce those free and floating appendices which are observed in certain old men, upon its inner surface ; externally a thin fibrous web, which passes from the external surface of one rib to the other, separates them from the superficial muscles, and seems to be blended with the fibrous bundles which are naturally mingled with the fleshy fibres. These two muscular planes exist throughout the whole extent of the costal region, whilst the external alone is found in the dorsal, and the internal in the sternal region.

v. *The Arteries.*

The *Intercostal* is the only one which deserves much attention on account of its size and position, relatively to the operation of empyema, on the one part, and to penetrating wounds of the chest, on the other. This artery is situated between the internal intercostal muscle and the cellular layer which separates it from the external, and runs to place itself in the groove of the inferior border of the rib, just where that curvature commences which forms the angle of this bone ; it passes to the extent of some inches thus enclosed in a canal, which is muscular internally, and osseous posteriorly or externally ; so that we might, if I may so say, shave the rib, as far as the middle of the side of the chest, without wounding the artery : but then this vessel becomes more and more isolated, and finally places itself completely under the margin of this bone ; as it advances farther towards the sternal region, it loses much of its volume, and inosculates with the external branches of the internal mammary artery. The intercostal artery, in its course, gives off a great many branches, which meet upon the external surface of the corresponding rib, and

which traverse the deep muscles in order to ramify in the superficial: but there is only one among these branches worthy of notice; it is that which separates from the trunk towards the middle of the space, and which runs obliquely forwards to the superior border of the rib below, in order to reach the external muscles. Its point of origin is so variable that we are not always sure of avoiding it in paracentesis thoracis; but fortunately it is seldom so large as to give rise to a dangerous hæmorrhage. In general, the trunk of the intercostal artery lies much nearer the pleura than to the superficial muscles of the thorax, and is more easily wounded the nearer we approach the anterior region; therefore, in order to avoid this accident, it is customary to penetrate the thorax, in operations, by cutting before the angle of the ribs. We should also, in these operations, be careful to divide the tissues nearer the inferior than the superior rib, and remember that, in certain diseases, the secondary branches acquire double and even triple their ordinary dimensions.

It follows then from the position of these arteries that they may be divided in the operation for empyema, by simple puncture, penetrating wounds, and in the evacuation of an internal collection, an abscess of the liver, for example; finally by fragments or spiculæ of fractured ribs. In all these cases, let there be a wound or not, it would be almost impossible to seize the vessel with the forceps and tie it; from without, we cannot compress it, and therefore the blood which is almost constantly extravasated into the chest, instead of escaping externally, soon gives rise to alarming symptoms. Now it is evident that the thread passed by Gérard around the rib, by means of a curved needle, in order to embrace the artery, or by Goulard with his needle having a long handle and perforated near its point, should be rejected; on the one hand, because it exacts a double wound, on the other, because the artery would not be completely flattened by it in the groove of the rib; finally, because acting upon one extremity only of the divided vessel, the hæmorrhage might continue from the other. The *jeton* of Quaisnay, the *plaque* of Lottery, the complicated machine of Bellocq, would be still less certain; and all these means would be advantageously replaced by those which have been recommended by Desault and Sabatier. After having introduced through the wound, into the thorax, a small empty sac,

made of linen, oiled silk, or a portion of bladder, which should be retained externally by threads, it would be easy to fill it with lint or any other substance, and thereby give it such a size as will prevent its escape through the intercostal space. By this means the compression will act upon the two divided extremities of the artery at the same time, in a certain and exact manner, without much inconvenience to the patient.

The other arteries of the costal region, are, for the most part, twigs of the preceding, which anastomose, superiorly and anteriorly, with the sub-scapularis or external mammary; superiorly and posteriorly, with the scapular branch of the cervicalis descendens. All these branches ramify in the superficial muscles, the cellular layers and the skin; they are but small, however, in the healthy state, and are not of actual importance in surgery, except by forming chains of communication between different remote parts of the body.

VI. *The Veins.*

These vessels are disposed exactly in the same manner as the arteries.

VII. *The Lymphatics.*

They form two series, which follow two different directions. The superficial set ascends to the glands of the axilla, whilst the deep seated, following the course of the bloodvessels, run from the intercostal spaces upon the sides of the vertebræ, or into the glands situated in the anterior and posterior mediastinal spaces: whence it follows that diseases of the skin or of the superficial layer frequently produce affections of the axillary lymphatic glands, without acting upon those in the cavity of the thorax; whilst the latter frequently participate in deep seated maladies. A blister, for example, applied upon the costal region, will occasion pain and tumefaction in the axilla; a sarcoma, or caries of the ribs, on the contrary, will re-act behind the sternum or before the spine.

VIII. *The Nerves.*

The serratus magnus anticus muscle derives its nerve from the fourth and fifth cervical pairs, and might, consequently, preserve its action although the spinal marrow had been divided in the upper part of the dorsal region. Some filaments are also sent off from the brachial plexus to the latissimus dorsi and pectoralis major; but the nerves proper to this region are the intercostals, each of which is nearly of equal volume with the artery of the same name, follows the same direction, is situated below and in contact with it, and divides in the same manner; so that the opening of the vessel alone, almost certainly indicates the division of the nerve. However, these nerves descend farther than the artery into the space filled by the muscles, and soon cross the internal surface of the inferior rib. The last especially, which some persons have considered as the first lumbar branch, soon deviates from the osseous arch, in order to pass into the interval of the muscular layers of the abdominal parietes.

IX. *The Skeleton.*

It is formed by the bodies of the last seven ribs, and is remarkable for the disposition of these bones and their relations with the circumjacent organs. We have just seen that the ribs were covered externally by large muscles; that their margins were fixed by others, and lodged the principal vessels and nerves, and that internally they were lined by the pleura only. It must therefore follow from this arrangement that their fractures, whether produced by a force which tends to increase the curvature of these bones, or to diminish it, will be attended with displacements and symptoms more or less serious, according to the situation of the solution of their continuity. Thus, does the fracture exist in the course of the curved line from which the serratus magnus originates? this muscle will draw the posterior fragment outwards, upwards and backwards, whilst the obliquus descendens will carry the anterior fragment of the bone in the opposite direction. Is the fracture situated further backwards and upwards? then the latissimus dorsi and serratus anticus will act upon the anterior

fragment, will tend to make it ride over the posterior, and the displacement, in relation to length, will be considerable. If the ribs are broken nearer their anterior extremity, the over-lapping will be more difficult, because at the same time that the serratus magnus tends to draw one of the portions outwards, and that the other is drawn by the pectoralis major in the same direction, the obliqui, transversalis and diaphragm act upon the latter, in order to draw it downwards and inwards. However, as most of these muscles are at the same time attached over a pretty great extent of the external surface of the ribs, it is seldom that the displacement can be carried very far; more especially as the sternum, on the one hand, and the spine on the other, equally oppose it, in maintaining, by means of the sound ribs, the fragments in a position which can scarcely deviate from the natural state. It is not in this way then that fractures of the ribs become dangerous, but from the nature of the organs which have been wounded at the same time, and the derangement of function consequent thereto. In fact, if this fracture is direct, the pleura, lungs, as well as the intercostal vessels and nerves, will generally be stretched, even torn, and hence extravasations, inflammations of the chest, etc. If, on the contrary, it is produced by a counter-stroke, the fragments will have lacerated more or less the external soft parts, likewise the vessels, nerves and pleura; then we may expect inflammations, abscesses, and pains increased especially by the respiratory movements. Finally, if the fracture is comminuted, if spiculæ are detached, as frequently happens, these osseous points will wound the lungs the intercostal artery, or the external organs, or all these parts simultaneously, and will in all cases act as foreign bodies.

As the true ribs become much shorter and less flexible as they ascend, it is evident that those which are most superior would be most readily fractured, if, on the other hand, the shoulder, the arm, and the muscles, did not protect them very efficaciously above, in the whole axillary portion, whilst inferiorly, or in the costal regions, properly so called, they are almost uncovered, and much more exposed to external violence. When one rib only is broken, which is unusual, as the displacement can only be produced by the same impulse which fractured the bone, it always takes place inwards; these isolated fractures are most frequently

produced by balls or other projectiles propelled by gunpowder ; their frequency, however, is not proportionate to that of wounds of this species, and for these reasons ;—if the vulnerant body strikes near one of the borders of a rib, it will glance and traverse the intercostal space and chest ; if, on the contrary, it is driven against the middle of the external surface of the bone, as the latter may yield and spring back, the foreign body will still be turned aside, and in this case it will plough through the thoracic parietes from before backwards, or from behind forwards, without producing fracture or penetrating into the pectoral cavity. In the lateral region of the thorax, the ribs are more flattened, and those which are most superior are so solidly fixed, that a knife, sword, etc., might pass along one of these bones, in the direction of its length, without fracturing it, or, at least, merely detaching some scales, and, again, in such a manner that the point of the instrument may be broken off and left in the body of the rib, projecting into the chest. Such a case, an instance of which came under the care of Gérard, would be somewhat embarrassing, especially if the weapon was broken off so near the osseous surface that it could not be taken hold of externally ; then the means employed by this surgeon, that is to say, a steel thimble placed upon the finger and introduced through the intercostal space into the chest, in order to press the point of the weapon outwards, is the only one which would afford any chance of success.

The intercostal spaces must now be examined. They generally differ in breadth : the third is the broadest of all ; the first and second follow next ; the fourth, fifth, sixth, and seventh, differ but little from each other ; the last two are broader, but of less importance. It should be noted, that this difference in the breadth of the spaces which separate the ribs, is most evident in the anterior half of the chest, and that this gradual enlargement, which we observe from behind forwards, arises from the descent which the bones make at first, in order to ascend afterwards. This peculiarity merits some attention in surgery, because it renders the operation of empyema more easy before the angle of the ribs, than at the posterior part of this curvature. However, it is at the union of the two anterior thirds with the posterior third of a line drawn from the sternum to the spine, that we are

recommended to penetrate into the chest for the purpose of evacuating fluids. In giving this advice, surgeons supposed that the artery, which is there concealed by the rib, was less in danger, and that the fluid would flow out easier; but we will perceive directly, that these data deserve further investigation.

There enters into each intercostal space, 1st, the two intercostal muscles; 2d, two cellular layers; 3d, the intercostal artery and vein; 4th, the nerve of the same name. The inferior margin of the superior rib limits it above. Thin and excavated internally, forming a groove, which disappears anteriorly, where this part of the rib is rounded, this margin, considered in its *ensemble*, is convex outwards and downwards. The superior border of the inferior rib is thick, obtuse, concave throughout its whole extent, and its direction is that which we ought to follow, when we traverse one of the intercostal spaces.

Now the operation of empyema may be the object of several anatomical remarks. Thus, although we might perform it indiscriminately upon all of the intercostal spaces, and in every point of their extent, yet, unless from absolute necessity, we only do it upon some one of them, and upon one part in preference to another. We do not operate, for example, upon the five or six superior, because they are covered by the shoulder and the pectoralis major muscle; besides, extravasated fluids do not accumulate in the upper part of the thorax; we do not operate upon the last two, because, the diaphragm which naturally rises up against their internal surface, might be divided and thereby allow the instrument to penetrate into the cavity of the peritoneum; neither do we select the anterior third of these spaces, notwithstanding they are broader in this portion; in the first place, because it is difficult to avoid the arteries, next because the matters are usually collected more posteriorly, and especially because we cannot render this part the most dependent. Finally, we should not perform the operation for empyema at the posterior part, as it would then be necessary to cut transversely, sometimes the trapezius or serratus posticus inferior, and always the latissimus dorsi; because also the space is narrower, and the vessels and nerves are not so well protected by the rib. From what has preceded we conceive, that, in order to give issue to liquids collected in the thorax, it will be necessary to penetrate into this cavity, anterior to

the latissimus dorsi, and, for this purpose, we can only select a point between the hollow of the axilla and the last intercostal space but one. It is between the second and third ribs, counting from below upwards, that Verduc and some other surgeons have advised making the opening, on either side, because this space corresponds to the point which is best adapted for the discharge of the pus; but as the diaphragm is pushed up by the spleen on the left, and by the liver on the right, we prefer operating upon the third space, as recommended by Dionis, Garengéot, Le Dran, Bertrandi; or upon the fourth, according to the advice of Sabatier, MM. Boyer, Richerand, etc. If we select the right side, it will be imprudent to operate lower down, not only because the diaphragm rises during expiration, but also because this organ may contract adhesions with the thoracic parietes, in which case it might be readily transfixed and the instrument enter the belly. M. Laënnec was witness to an accident of this kind. On the other hand, this professor has remarked that the diaphragm sometimes ascends to a level with the sixth and even the fifth true rib; wherefore, he thinks that it would generally be more proper to perform the operation for empyema in the middle of the chest; especially as in females, and even in many males, this point is actually the most dependent when the patient lies horizontally and a little upon the side. It is for the same reason that Samuel Cooper* recommends the incision to be made between the sixth and seventh true ribs. Be this as it may, it follows from these different opinions, that the place of election for paracentesis thoracis is not yet well determined, and that we may perform it, with nearly equal advantages, upon the third, fourth, fifth and sixth intercostal spaces in the lateral region, (counting from below). In either of these places, it would only be necessary to divide the skin, the adipose layer, the membrane of greater or less thickness which covers the muscles, the external and internal intercostal muscles, and the pleura. By following the direction of the rib, the digitations of the serratus magnus and obliquus externus will only require to be separated; and if the opening is made immediately before the latissimus dorsi, it will always be easy to avoid the artery, since it is then entirely concealed by the rib. Surgeons have particularly advised

*Surgical Dictionary.

proceeding with great caution when dividing the pleura, for fear of wounding the lung ; but it seems to us that there is very little foundation for such fears. In fact, if the respiratory organ is free from adhesions, the external air will promptly repel it, and drive it beyond the reach of the instrument ; if, on the contrary, it adheres more or less intimately, we will wound it in spite of all our precautions ; and, moreover, what dangers can result from wounds of such a nature ? Finally, if we operate upon the abscess itself, we run no risk at all. We think then that empyema, instead of being a delicate operation, might, when we have properly ascertained the intercostal space, be reduced to a simple incision, similar to that of opening any deep-seated abscess whatsoever.

After this operation, as well as after penetrating wounds of whatsoever nature they may be, as the intercostal muscles are divided transversely to the direction of their fibres, when they retract, they leave an opening into which the lung may insinuate itself and form a tumour of greater or less volume externally. The observations of Schenkius, Tulpius, Fabricius de Hilden, and Ruysch, support this assertion. It may also happen that the external parts will cicatrize, whilst the intercostal aperture remains: the lung would then form a complete hernia under the skin, especially during inspiration ; a remarkable example of which is related by Sabatier. On this occasion, we may also notice another still more singular, which was pointed out to us by M. J. Cloquet, whilst dissecting for his anatomical lectures in 1821. This case occurred in a man of about fifty years, who had several of his ribs broken, by the wheel of a carriage, nine years previously ; the middle portion of the fifth, sixth, and seventh ribs had disappeared, and left a space large enough to admit the fist ; a space through which the lung protruded and projected under the skin, whenever this man, who otherwise enjoyed perfect health, inspired or made any exertion.

Sect. 4. Mammary Region.

It is formed by the mammæ, and cannot have any exact limits : in man, it scarcely exists, and does not merit any special consideration ; in the female, on the contrary, it is an important region, but after puberty only ; previous to this epoch, the breast is only

rudimental, as it always is in the opposite sex. The volume, form and density of this organ vary according to the age of the mature female, her state, constitution, etc. Thus the mammæ represent two half spheres, regularly rounded and firm upon the fore part of the chest of young virgins; soft, pendent, and more or less flattened, in women who have had children. Sometimes they form a considerable relief; at others, we scarcely distinguish them, and this may depend upon their intrinsic volume or the abundance of the cellular tissue which surrounds them. If, on the one hand, the well-formed breasts concur in setting off the graces and elegance of the sex, if their functions render their preservation of the highest importance, on the other hand, they sometimes embarrass the surgeon considerably, when it becomes necessary to apply an apparatus upon the thorax. For example, the bandage of Desault, in fractures of the clavicle; those which are used for fractures of the ribs; in short, all compressive bandages which we are obliged to apply around the thorax of females, require considerable precaution, on account of the mammæ. These organs also prevent our deriving such satisfactory results in this point from percussion and auscultation, whether mediate or immediate, as in man.

CONSTITUENT PARTS.

1. *The Skin.*

The skin of the breast is delicate, smooth, soft to the touch, white or slightly bluish in the pubescent virgin; uneven, wrinkled, thicker, and less white, in those who have borne several children, or who have arrived at a certain age. In the centre of the region, it is surmounted by the *nipple*, a sort of homogeneous, spongy, erectile, extremely sensible, rugous, reddish, or yellowish body, perforated by a great many foramina, which lead to the lactiferous ducts, surrounded by an areola of greater or less breadth, which is generally of a rosy or livid colour, analagous to that of the nipple itself. Here, this membrane possesses but a very limited extensibility, and encloses a great number of sebaceous follicles; therefore, it cracks very easily during lactation, when it is irritable. The proper tissue of the nipple resembles

bacon : all the elements composing it are so blended together that it is difficult to distinguish them, and hence, although Ruysch affirms that he has traced the nervous filaments as far as the cutaneous papillæ, it is doubtful that he has done so.

II. *The Subcutaneous Layer.*

This layer differs from that of the preceding regions by its thickness, which is much greater ; by its more numerous and larger adipose cells, and by including the mammary gland. The cellular tissue is rather filamentous than lamellated, and sends off many septa, which are intimately attached to the internal surface of the skin, and are prolonged across the secretory organ.

III. *The Arteries.*

They appertain to the internal mammary, intercostals, to the anterior thoracic, and especially to the external mammary or inferior thoracic artery. The latter is the largest ; its principal branches are found on the outer side of the region, under the margin of the pectoralis major ; these are the vessels divided by the instrument in terminating the amputation of the breast, and which most frequently give rise to hæmorrhage in this operation. The branches of the first ramify upon the sternal side, and become more superficial ; the second supplies the superior part, and they all anastomose with one another, forming a plexus, which is so disposed that the extirpation of the mammary gland would rarely be followed by a dangerous bleeding, if the disease had not caused an augmentation in the volume of the arteries. We must expect, therefore, during the operation, to meet with arterial branches, which will be more numerous and large in proportion to the duration and size of the tumour. In all cases, it must be recollected that these vessels should be sought for in the superior part, at the inner or outer side of the wound, because in its inferior half they are generally very small ; we should likewise keep in mind, that, as these arteries run in the cellulo-adipose layer, they will retract as soon as divided, and that their mouths will also contract so much as to render their ligature difficult after the removal of the tumour. It is with the view of avoiding

the inconveniences attached to this disposition of the arteries, that surgeons recommend us to tie them as soon as they are divided by the instrument. This advice, dictated by prudence, ought always to be followed, especially when we wish to effect an union by the first intention; then, in fact, it is necessary to prevent the blood from becoming extravasated behind the approximated lips of the wound, if we wish them to agglutinate: but if the loss of the substance is so great that we are obliged to dress it as an open sore, or if the surgeon, from any other reason, does not think proper to dress it otherwise, we think that it would always be possible, under ordinary circumstances, to secure the arteries, after the excision of the diseased parts, so that there would be no apprehension of severe hæmorrhage. The other method, however, has no other defect than that of uselessly prolonging the operation.

IV. *The Veins.*

Some of them are disposed as the arteries, which they accompany and exceed in volume, and to which they generally adhere so intimately that it is often very difficult to separate them: the others are situated under the skin and even in the gland. The arrangement of the latter is very different from that of the arteries; they intersect each other a great number of times in the compact tissue which unites the mammary gland to the skin of the areola; and, in women who have nursed many children, they form a species of plexus, more or less evident and complicated around this coloured part. As we remove from this point, the subcutaneous veins of the breast are so large that they are delineated through the skin; indeed it is not uncommon to see them become varicose* in females, of a certain age, who have fulfilled the duties of maternity, in those who have been affected with chronic enlargement of the breasts, etc. It is these enlarged vessels which give to the cancerous breast that disagreeable appearance which induced the ancients to compare this disease to a species of *lobster*, or *crab*, sticking to the organ in order to devour it. The veins of the glandular texture have very thin

*M. Briquet, thèse, etc. 1824.

tunics, and are always larger than the arteries; almost all of them pass into the veins of the axilla, some empty into the internal jugular or subclavian, on the inner or outer side of the sternomastoid muscles, and may be lacerated by the osseous fragments, in fractures of the clavicle, so as to give rise to extensive ecchymoses. In short, all these vessels soon enter into the surrounding regions, where we have already examined them.

v. *The Lymphatics.*

We do not find any lymphatic glands in the mammary region.

The vessels are a continuation of those which were pointed out in the costal, axillary and sternal regions, and which pass to the glands in the anterior mediastinal space and to those in the cavity of the axilla, on the one part; and to the glands of the infra-hyoideal and supra-clavicular regions, on the other.

vi. *The Nerves.*

These are also the same branches as those which we have already seen in the other regions of the thorax.

Thus, the supra-clavicular filaments of the cervical plexus enter this region in order to ramify in the skin and the superficial laminæ of the cellular layer; the thoracic branches of the brachial plexus are distributed to the gland and the adipo-cellular tissue; the twigs of the corresponding intercostal nerves, and those of the posterior thoracic are also lost in it, after having passed through the muscles. These different filaments are so small that their diseases cannot be correctly appreciated: from analogy, however, and certain facts, we are induced to believe that they sometimes undergo changes which produce in the breast of females exquisite pain, and which continues during a long time without any organic lesions being observed in it.

vii. *The Mammary Gland.*

Its circumference is irregular; so that, in extirpating it, some lobules might be left behind, although the intention was to remove the whole of it. Its anterior or superficial surface is uneven,

tuberculated, convex, and separated from the skin by a layer of cellular and adipose tissue, which increases in thickness in proportion as it recedes from the nipple. Its deep surface is plane and smooth, being covered by a very distinct aponeurotic fibrous sheet; it is separated from the pectoralis major only by a small number of cellular lamellæ; and the relations of the gland with this muscle vary but little, whatsoever may be the embonpoint of the female. The divers lobules are separated by processes of fibro-cellular tissue, which become hard, completely fibrous, and sometimes cartilaginous or osseous, in scirrhus enlargements (*cancers lardacés*). These plates, which are also attached to the skin, divide the organ into several compartments, and permit pus to form in a great number of distinct *loculi*: therefore, when abscesses are developed in the breast, it is not unusual to see several of them open successively, or require to be punctured separately. In *colloid* or *gelatiniforme* cancers, the *hydatiforme* of English authors, these intersections also perform an important office. They give to these tumours that lobulated disposition, which constitutes one of their principal characters; but they never extend so far as the muscles: they generally terminate in the lamellated layer which covers the gland posteriorly. In the adipose tissue, on the contrary, we observe these intersections prolonged in all directions, which prolongations become hardened, and are transformed into the fibrous or scirrhus texture in cancers of this nature, of which they then seem to form the roots, and which we should carefully remove, if we wish to obtain some chance of success from the operation. As in the natural state, and especially in the pathological, the gland or the disorganizing tumour descends more or less below the pectoralis major and into the grooves which separate the inferior margin of this muscle from the ribs, it is necessary, in order to avoid dividing this fleshy border, to dissect the part which we wish to remove, from above downwards. It is also necessary, in order to prevent constant tractions upon the cicatrix, that the incisions should be made obliquely to the fibres of this muscle, that is to say from above downwards and from without inwards; finally, in order that the pains which its contractions occasion during the treatment of the wound, consequent to the removal of the breast, may be moderated, it is necessary that the arm should be kept immoveable.

We must also recollect, in relation to this operation, that the disease frequently obliges us to remove a portion of the muscle in question and sometimes even of the ribs, as well as a part of the pleura itself, as is proved by the bold operation of this nature performed by M. Richerand. In all these cases, as several bundles of the pectoralis major remain unmolested above the cicatrix, it follows that, after the cure, the arm recovers the freedom of its movements in a much more perfect manner than would at first have been supposed.

VIII. *The Lactiferous Ducts.*

The lactiferous ducts arise, like all excretory tubes, by a great number of radicles, in the lobules of the gland, and some of them, according to Haller, from the adipose layer, all of which run towards the nipple and open separately upon its surface. Some of these lie so near the skin, and are sometimes so large in certain women during lactation, that a very slight incision in the neighborhood of the areola, may open them; in which case, a fistula may be the consequence, which will not exist however except during lactation. These canals appear to be the special seat of the disease known by the vulgar name of "*ague in the breast,*" or engorgement of the breast of lying-in women. In these cases it really seems that the milk coagulates within them, and thereby becomes a foreign body, irritating, by its presence, and producing inflammation of the surrounding cellular tissue. It is from this opinion that ammoniated liniments are recommended, for the purpose of restoring to the milk its natural fluidity, and which actually produces astonishing effects, when employed by a skilful and prudent physician.

ART. II. OF THE INTERIOR OF THE THORAX.

We have now to examine successively: the partition which separates the chest into two cavities, and the organs included in this partition; the two pectoral cavities themselves, in their relations with the viscera which they contain; finally, the base and the summit of the thorax.

1. *The Median Septum or Mediastinal Region.*

By making an abstraction of the column formed by the bodies of the vertebræ, which prolong this septum backwards, we observe that it is constituted by the approximation and junction (*adossement*) of the two pleuræ. It has the figure of a triangle rounded off towards the summit of the cavity which it divides; its posterior border rests upon the fore part of the spine, and follows the direction of this column, upon the sides of which, the two pleural laminæ are applied.

This separation of the two pleuræ upon the anterior part of the bodies of the vertebræ, constitutes what certain anatomists call the posterior mediastinum. It contains the aorta, on the left; the vena azygos, on the right; the œsophagus, before, in the middle, and upon a more anterior plane; the thoracic duct, behind; lastly, some cellular tissue, lymphatic glands, etc.

(*a*) The *Aorta* does not penetrate into the posterior mediastinal space, until after it has curved around the left bronchus; then it places itself deeply upon the corresponding side of the vertebræ, and, as it descends lower, it approximates the median line and becomes more anterior. It is then found in relation:—anteriorly and on the left, with the pleura, and mediately with the root of the left lung, the pericardium and the left side of the heart; internally and anteriorly, with the œsophagus and the par vagum of the left side, which from being a half inch and even an inch distant from it above, promptly approximate it as they descend, and are united to it below by a pretty dense cellular tissue. Its posterior and internal portion rests upon the vertebræ, between the thoracic duct which runs along its inner side, and the great sympathetic which is situated on its outer side; so that it crosses all the costo-vertebral articulations. From this disposition of the great artery of the body, we may perceive that its aneurismal tumours will compress different organs, according to the point which they may occupy below the transverse portion of its arch. Thus, if the aneurism is situated above, and it projects forward, it will compress and flatten the left bronchus and pulmonary vessels; whence will result the difficulty of breathing and the disturbance in the circulation, which we so often observe in this dis-

case. If this tumour is situated lower down, it will either compress the œsophagus, the *nervi vagi* and the thoracic duct, if it is developed on the right side; or it will push the heart forwards, if it is situated upon the anterior and left portion of the artery; finally, it will act more particularly upon the vertebral column and the great splanchnic or ganglionic nerves. It is on account of this disposition, that aneurisins may open into the bronchi or œsophagus; that they may burst still more frequently into the thorax; that they may occasion disturbance in the digestion and circulation of the chyle, nervous symptoms, and sometimes produce absorption of the bodies of the vertebræ; the fibro-cartilages, etc., remaining for a longer time unmolested.

The aorta gives off, in the space which we are examining, the *intercostales*, *mediastinales posteriores*, *bronchiales*, and *œsophageæ*. None of these branches are so large as to merit of themselves much attention; we should note, however, that the first anastomose with the internal mammary, and superior intercostal, which are derived from the subclavian, and with several branches from the axillary, so as to furnish a connected chain between it and the lumbar, epigastric, etc. arteries; a chain which seems to be capable of continuing the circulation in case the aorta should be obliterated, as has been observed by Dr. Graham.*

(b) The *vena azygos*, which receives directly almost all the intercostal veins of the right side, where it is disposed as the aorta is on the left, is also the rendezvous of the most of those of this last side, by means of the *demi-azygos*, which has crossed the spine transversely under the aorta and œsophagus. But at the moment this vein turns over the right bronchus, it ceases to appertain to the posterior mediastinal space. The azygos is only of importance in surgery, inasmuch as it forms an union between the two *venæ cavæ*, and might thereby re-establish the venous circulation, if the calibre of one of these large vessels should be obliterated between their termination in the auricle and the points where they receive the extremities of the azygos.

(c) The *œsophagus* is covered by the trachea, in the same manner as in the neck, as far as the origin of the bronchi; its posterior relations are similar also on the left; it is coated by the

* *Med. Chir. Transactions*, vol. 5.

common carotid and sub-clavian arteries on the right ; it is not very remote from the arteria innominata and superior cava ; consequently this tube might be compressed by an aneurism of the arteries which originate from the arch of the aorta. As it continues to descend it inclines slightly to the right, passes behind the trunk of the pulmonary artery, the origin of the aorta, the heart and the inclined portion of the diaphragm, having behind it and upon its sides the right intercostal arteries and the aorta, the left intercostal veins and the vena azygos, the thoracic duct, some lymphatic glands, and, in a more or less remote manner, the dorsal vertebræ. Beginning from the bronchi, it is also surrounded by the two nerves of the eight pair, which forms a species of plexus around it. Before it passes into the abdomen, it again inclines towards the left, and thus forms in the chest an elongated curvature, the convexity of which looks towards the right, whilst in the infra-hyoideal region, we observe an opposite disposition. This direction should be kept in mind, when we attempt to pass instruments from the mouth into the stomach. It is unnecessary to state that, if the œsophagus was the seat of tumours, it might compress the aorta and all the other canals which surround it, and that the nervous plexus, which covers it, sufficiently accounts for those dull and sometimes acute pains, which are experienced when aliments or any other substances are arrested in their progress through it.

(*d*) The *Thoracic duct*, placed between the organs which we have just examined, behind the œsophagus, is at first on the right of the median line, which it approximates more and more in proportion as it ascends, and finally passes to the left towards the upper part of the fourth dorsal vertebra. It is enveloped in an extensible cellular tissue, adheres but slightly to the other organs, which may nevertheless compress it against the vertebral column when their dimensions are augmented in consequence of morbid alterations. Its diseases are as yet but little known ; M. Andral Jun., however, has met with it degenerated into a tuberculous matter, which also filled its cavity. In a subject dissected by Dr. Riley, in March 1825, at the *école-pratique*, we found it in a varicose state, dilated in different places to the size of the little finger.

(*e*) The *Lymphatic Glands* are numerous here, and form a kind of chain ; they are traversed by almost all the lymphatics of the abdomen, and receive those of the thoracic parietes, which

accompany the intercostal vessels; hence, they frequently become swollen from scrofulous, and cancerous diseases, etc., which have their seat in the sides of the chest, or in the belly. From the anatomical relations we perceive, that, if they should become greatly enlarged, they will displace the heart, aorta, œsophagus, etc. or compress and flatten these organs; and thereby occasion serous infiltrations, indigestion, marasmus and difficult respiration.

(f) The *Cellular tissue* is always abundant in this space; superiorly, it communicates with the deep cellular tissue of the neck; so that the pus which forms in the infra-hyoideal region may readily descend in the chest along the spine, without being extravasated into the pleuræ. Inferiorly, this tissue forms a communication between the posterior mediastinal space and the abdominal cavity, by means of the apertures through which the œsophagus and aorta pass, and may thus conduct into the belly, behind the peritoneum, fluids which have been secreted into the posterior interval of the thoracic septum. It is in this manner that a great many *abscesses by congestion** are formed.

Anterior to these different parts the pleuræ are arranged in the following manner: they are completely joined at the fore part of the œsophagus, from the diaphragm to the base of the heart, below which they are equally in contact, but much nearer the vertebræ; in fact they touch each other even behind the œsophagus, because the aorta and vena azygos do not exist between them until they get on a level with the third dorsal vertebra, opposite to the heart. These laminæ separate much more, on the contrary, in order to envelope this organ, so that the species of triangular canal formed by the mediastinum posteriorly, is at first very narrow, but afterwards very broad, and contains a great abundance of cellular tissue behind the heart; that at length it includes entirely the aorta, œsophagus, etc. below the central organ of the circulation. After these two membranes have become more or less intimately joined anteriorly, they again diverge from each other and produce another space behind the sternum, which appertains to the anterior border of the mediastinum, and which we find described by several authors under the name of anterior mediastinum. This space, the existence of

* *Abscès par congestion*, purulent collections which derive their origin from a remote point.—*Transl.*

which has been denied by Bartholin, Ruysch, Winslow, and which Gavard says he never met with, was admitted by Hunter, Senac, Sabatier; and all anatomists of the present day are of the latter opinion. We must not, however, judge of its dimensions during life, from what we observe upon the dead body, after the sternum is removed. In fact, if for the purpose of examining it, we remove all the ribs except the first and last, in order to maintain the sternum in place, we distinctly perceive that the right pleura is adherent very near the median line of the posterior face of the breast bone, and that the left, although much nearer the border of this bone below, does not, however, entirely abandon it. Be this as it may, the anterior splitting of the mediastinal septum, and the space thereby produced pass obliquely from right to left and from above downwards; so that in order to penetrate into the thorax without perforating the pleuræ, we should choose the median line above, and the left side of the sternum below; in cases, for example, in which the supple and abundant cellular tissue which fills this space is inflamed to such a degree as to occasion an abscess, as Avenzoar states occurred in himself, we might, by recollecting this disposition, perforate the sternum and give exit to the fluid, as advised by Columbus, and practised by Purmann and La Martinière. The case related by Salius-Diversus proves that the inflammation of the cellular tissue contained in this space, may occasion the death of the patient, notwithstanding it may have remained circumscribed in it; those by Carpi, Marchetti, Spigel, demonstrate that penetrating wounds in this situation, do not necessarily open the serous cavities; and, from what Freind says, we perceive that syphilitic affections may sometimes occasion purulent collections here, which might be discharged by means of the trepan.

Furthermore, this space represents pretty correctly two triangles joined by their apex before the anterior ventricle of the heart. In the first triangle, the base of which ascends almost to the supra-sternal notch, we find some lymphatic glands, much cellular tissue, the thymus in the infant, and the mammary artery. When these parts are unusually developed, or when they become the seat of tumours of moderate volume, as they cannot

protrude externally through the sternum, they ascend in the neck, pass upon the trachea, and are sometimes mistaken for diseases of the thyroid gland; or they may project backwards and compress the arch of the aorta and the large branches which arise from it, the superior cava and subclavian veins. The second triangle is of greater length; its left side descends as low as the posterior surface of the eighth cartilage; it is filled with cellular tissue, lymphatic glands, and discovers the anterior surface of the pericardium. It is in consequence of this disposition that M. Laennec advises opening this bag, by trepanning the left side and lower part of the sternum. By this operation, which was first proposed by Senac, we would avoid opening the pleuræ; whereas Desault, Skeildrup and Romero, in their essays, could not reach the pericardium without transfixing the left thoracic serous membrane.

Superiorly, the cellular tissue which fills the anterior mediastinal space is continuous with that upon the fore part of the trachea, and with the sub-aponeurotic lamellæ of the neck; inferiorly, this tissue is prolonged between the peritoneum and abdominal muscles, in passing behind the cartilago ensiformis, through an aperture, of greater or less breadth, which separates the anterior digitations of the diaphragm. Hence it follows that tumours formed behind the sternal appendix may be prolonged almost to the neck by following this space; that abscesses especially will easily descend from the infra-hyoideal region and make their appearance in the epigastric region, etc., and that, on the other hand, the same diseases, primitively developed in the inferior triangle of this space, might be prolonged into the epigastric region.

We must also recollect that the internal mammary artery runs along the borders of the sub-sternal mediastinal space throughout its whole extent, and that the lymphatic glands are principally met with in the track of this vessel. All the other organs which we perceive in the bottom of this separation, appertain more especially to the septum itself.

The inferior border of the mediastinum, resting upon the diaphragm, presents, anteriorly, the broadest part of the sub-sternal space; in the middle, a separation, which is still more exten-

sive, for the lodgement of the pericardium; posteriorly, the pleuræ are in contact upon the fore part of the œsophagus, and again separate to form the spinal space.

At the summit, all the parts are confounded in the superior opening of the thorax; but the pleuræ are very much separated.

In the inferior half of the mediastinal septum we find the heart, pericardium, and inferior and superior venæ cavæ. The position of the heart is such that its apex strikes the fifth intercostal space and the sixth rib on the left side, whilst on the right, it does not pass beyond the sternum: therefore penetrating wounds are much more dangerous in the first direction than in the second: hence, also, it is its right ventricle which is most exposed to the action of vulnerant bodies, unless they have been directed transversely; and it is the importance of the functions of this organ especially which renders its wounds so serious. Some facts, however, would lead us to believe that wounds which even penetrate into its cavities are not constantly fatal. The case related by Latour of Orleans, in which it is stated that a man lived six years after having been wounded in the chest by a ball, although on autopsic examination the foreign body was found in the cardiac septum, is one of the most inexplicable. In 1818 we, in conjunction with M. Bretonneau, transfixed the heart of several dogs, with thick needles, and in several of these animals no disturbance followed. In 1822, we repeated this experiment in public, in the amphitheatre of the *École-pratique*, upon a dog of middle size; we passed a needle six inches long through the heart, four different times, no inconvenience resulted, and the animal enjoyed good health six months after.

A collier, fifty years of age, of intemperate habits, died at the hospital of *la Faculté*, in the beginning of the present year. In a quarrel nine years previous, a common table knife was thrust into the thorax of this man, through the left side. For several months it was expected that the wound would prove mortal; but the patient at length recovered, remaining subject to palpitations. On examining the body we found the pericardium opened opposite to the cicatrix in the thoracic parietes, and the heart itself presented a fibrous line which extended throughout the entire thickness of the right ventricle, in the place corresponding to the loss of substance in the pericardium. Professor Bougon,

shewed this specimen to the Royal Academy of Surgery, and Baron Larrey has obtained a drawing of it.

The pericardium, divested of the serous laminae which cover it internally and externally, seems actually to be a continuation of the cordiform tendon of the diaphragm; its tissue becomes less dense, less compact, where it approaches the principal arteries, upon which it is confounded with their external tunic; that is to say, that around the aorta and the trunks which originate from its arch, the superior cava and the bronchi, the pericardium is transformed into lamellae analogous to those which envelope the trachea, œsophagus and the large vessels of the neck; or rather that the diverse deep sheaths of the infra-hyoideal region approximate each other inferiorly, and unite upon the origin and termination of the large vessels which proceed from or enter the heart, in order to form the fibrous sheet of the pericardium, and in this manner become blended with the diaphragm, and even traverse it by being prolonged upon the vena cava, œsophagus and aorta. Hence it follows, as Dr. Godman has very satisfactorily demonstrated, that the pericardium is continuous, without interruption, with the aponeuroses of the neck, on the one hand, and on the other, with the fibrous layers of the abdomen, by means of the sheaths which cover the aorta, œsophagus, etc., and that pus, or inflammations may easily extend from one of these regions into the other.

The inferior vena cava is here seen even in the cavity of the pericardium, which it does not abandon until it traverses the diaphragm. Free between the œsophagus, the heart and lungs, it is by this means protected, as it were, against every compression capable of completely obliterating its calibre; but it may be displaced by the dilatation of the heart, in aneurisms, by the right lung when swollen and hepatized in pneumonia, and thereby curved in such a manner as to impede the venous circulation: whence doubtless arises the engorgement of the liver, so common in these diseases and in phthisis, etc.

Above the heart, in the mediastinal septum, we find the sub-sternal curvature of the aorta, the convexity of which, turned forwards and to the left, is only separated from the first portion of the sternum by some cellular laminae; from which circumstance, the aneurysmatic dilatation of this trunk often determines

absorption or caries of the bone which covers it. On the left, the aorta is crossed by the phrenic nerve, par vagum and the recurrent, which embraces its concavity in order to pass back into the infra-hyoideal region. As it occasionally happens that persons afflicted with aneurism of the arch of the aorta lose their voice, the old surgeons attributed this phenomenon to pressure on the inferior laryngeal nerves. It is true that this cause may sometimes contribute towards it; but it is also probable that this accident most frequently depends upon the compression of the bronchi or trachea, which are surrounded by the artery or placed behind it. Furthermore, when the aortic arch, while yet within the pericardium, is morbidly dilated, it will compress, anteriorly, the anterior portion of this membrane, the cellular tissue, lymphatic glands, internal mammary vessels, and sternum; exterior to the pericardium, the thymus in the infant, a greater abundance of cellular tissue, and the same parts as lower down; posteriorly, the pulmonary artery, the termination of the trachea; more deeply, the œsophagus, thoracic duct, cellular tissue, lymphatic glands and the spine; on the left, the bronchus, the pulmonary artery and the two pulmonary veins of this side, the par vagum and phrenic nerves, and the top of the lung; on the right, the pulmonary artery, superior vena cava, the same nerves as on the left, but in a less direct manner: consequently, these tumours would disturb respiration and suspend the voice; would impair digestion by the compression of the nerves, and prevent deglutition by obliterating the œsophagus; would obstruct the passage of the arterial blood into the lungs, and oppose the return of the venous blood from these organs into the left auricle; would impede the venous circulation of the superior parts, by pressing upon the vena cava; derange the course of the chyle and lymph; and lastly, occasion absorption or caries of the vertebræ and sternum.

From these relations we may also explain, how it happens that the rupture of these aneurisms sometimes takes place into the left bronchus or trachea, and into the œsophagus.

The pulmonary artery comes next to the aorta, which it turns upon from below upwards, from right to left, and from before backwards; it is still in the pericardium when it divides, and its two branches, in their course to the root of the lungs, circumscribe an irregular rhomboid with the bronchi, the anterior sur-

face of which they cross, in order to place themselves between them and the pulmonary veins. That of the right side is the longest and largest; it is covered by the aorta, superior vena cava and the vena azygos. Posteriorly, it rests upon the right pulmonary veins; a little higher, upon the œsophagus, then upon the corresponding bronchus; its anterior part is also crossed by the phrenic nerve, between the vena cava and the aorta; by the cardiac ganglion and plexus, which separate it from the latter. The left pulmonary artery is shorter and smaller than the other; it rests, at first, upon the left auricle, and, in a remote manner, upon the thoracic aorta; it is next situated upon the fore part of the bronchus; the lung conceals it before, and the aortic curvature turns over it, embracing the pulmonary root; on this side, the diaphragmatic nerve is more immediately applied to it than upon that of the right. From these relations it is evident, that, if the pulmonary arteries became aneurysmatic, they would react in a serious manner upon the aorta, vena cava and pulmonary veins, the bronchi, phrenic nerves, etc.

The Pulmonary Veins are not of equal lengths: those of the left side, which are scarcely an inch in length, place themselves immediately before the primary divisions of the bronchi, run at first below the artery, but afterwards are situated upon its anterior surface, previous to penetrating into the lung; those of the right side are covered by the trunk of the pulmonary artery, the aorta, superior cava, and terminate in the same manner as on the left.

The superior vena cava is, consequently, anterior to all these parts, and lies very near the sternum; the phrenic nerve is before it, superiorly; but, in descending, passes to its outer side. The par vagum runs along its internal side, and remains more superficial than the trachea, as far as its bifurcation; but then it dips deeper, and directs its course behind the pulmonary root. On the left, these two nerves pass upon the corresponding face of the aorta, and are thus situated upon a posterior plane; the phrenic nerve continues its route before the pulmonary vessels, and penetrates, as on the right, between the laminæ of the pericardium; so that, when the heart is greatly dilated, these cords may be put on the stretch, and occasion pains in the neck as well as other nervous phenomena. In addition to the pulmonary ves-

sels and bronchi, which unite and intermingle in order to form the root of the respiratory organs, we also observe here a great number of lymphatic glands, which, from their situation, are called bronchial. These glands receive all the lymphatics of the lung, and frequently become swollen and disorganized in phthisis, in scrofulous persons, during the measles, whooping cough, and several chronic inflammations of the middle membrane of the respiratory passages. In such cases, they may compress the pulmonary veins or arteries, the bronchial vessels, and greatly derange the process of sanguification; they will also frequently press upon the bronchi, and contract adhesions with them; they will even perforate them, and if they suppurate, the fluid will be evacuated by these canals, as has been observed by M. Guersent. In a word, these organs are susceptible, in these cases, of giving rise to all the phenomena of compression which the dilatation of one of the principal arterial trunks ordinarily determines.

As we advance near the summit of the chest, the mediastinum encloses, from right to left, and from before backwards, the superior vena cava, which has received the subclavian, the right internal mammary, etc.; the arteria innominata, before and on the outer side of which are seen the nerves of the lung and of the diaphragm; lastly, the carotid and subclavian arteries of the left side.

The arteria innominata or brachio-cephalic trunk, is here the most important organ; it is about an inch and a half in length; it ascends, inclining slightly to the right, to a level with the sterno-clavicular articulation, where it divides, opposite to the point which separates the two portions of the sterno-mastoid muscle. It is covered, from the deep parts towards the skin, by the par vagum and right cardiac nerves; by the termination of the internal jugular, subclavian and thyroid veins, and the superior cava; by the origins of the sterno-thyroid and sterno-hyoid muscles; by the sternum, the head of the clavicle and the internal tendon of the sterno-mastoid muscle; besides, the different veins and the artery are enveloped in this place by a very strong fibro-cellular lamina; posteriorly it is removed from the trachea by some lymphatics and cellular tissue; on the right, it is very close to the pleura; finally, this trunk is so disposed, in the healthy state, that in order to discover it, it would be neces-

sary to depress the right shoulder firmly, at the same time that the head is thrown backwards and to the left, as much as the position of the disease will permit; to divide the sternal tendon of the sterno-mastoid muscle; to separate some veins which descend behind this muscle; to cut across the sterno-hyoid and sterno-thyroid muscles; to tear through a thick and strong fibrous plate; to depress the left subclavian vein, pushing back the jugular, par vagum and phrenic nerves toward the summit of the right lung, and lastly to pass a thread around the artery, by introducing the aneurismal needle from before backwards and from right to left, taking great care to avoid the right pleura and trachea. If we wished to discover the brachio-cephalic trunk by trepanning the sternum, as was mentioned in the anterior region of the chest, we should seize the artery below the left subclavian vein; but it is important to remark that it is necessary here to apply the ligature as high as possible, on account of the proximity of the aorta, which must render the formation of the clot in the root of the vessel which we wish to obliterate, less sure, if the thread is carried low down upon the artery. In whatever manner this operation may be performed, it is one of the most difficult and dangerous in surgery; upon the living subject, there must be something dreadful in it, and it requires all the knowledge and all the bold dexterity of modern surgeons, in order to dare to undertake it; indeed, it would seem, *à priori*, almost rashness to think of it, especially because it would appear as if the circulation must immediately cease in the right superior extremity, which does not receive any other arteries than those which it derives from the innominata. But reasoning must be silent, since observation has spoken. Twice, in fact, has this operation been performed: once in New-York by Dr. Mott, and once in Germany, by Graefe.* Notwithstanding they were not attended with complete success, these essays at least prove that life will be preserved in the limb and the other parts to which the arteria innominata sends its branches, since, in the first case, the patient lived until the sixteenth day, and in the second, about

* We have just been informed that the patient of M. Graefe survived four weeks, and that the operation would perhaps have been attended with complete success, if this dexterous surgeon had not removed too soon the *serre-nerve* which he is in the habit of employing and which he had applied upon the artery.

thirty days: then the circulation must have been maintained by the inosculations of the arteries of one side with those of the other.

As the brachio-cephalic trunk is supported by the sternum, it must, when diseased, readily compress the trachea and even the œsophagus, behind; the cava and subclavian veins before; the par vagum on the right, and the carotid on the left. Aneurismal tumours may be prolonged into the infra-hyoideal region, and be mistaken for aneurisms of the common carotid artery. Burns has delineated in his work on the *surgical anatomy of the neck*, a remarkable example of this kind, and we can conceive how dangerous it would be to mistake such a case, if we determined to seek for the artery below the tumour. Anomalies of the arteria innominata are very rare; nevertheless, we possess some pretty remarkable specimens of them, and during the preceding winter, we met with, in the dissecting rooms of the *Ecole-pratique*, a variety in the position of this vessel, which would have rendered its ligature impossible: after its origin, the arteria innominata passed to the left, in order to turn over the trachea, then penetrated between this organ and the œsophagus, and replaced itself on the right side at the moment of its bifurcation, but much more deeply than in the natural state.

The relations of the left carotid, in the upper part of the mediastinum, are the same as in the lower part of the neck; anteriorly, it is covered by the thymus gland in the child, some lax cellular tissue and lymphatic glands in the adult, by the subclavian vein, the left sterno-thyroid and sterno-hyoid muscles; lastly, by the sternum and sterno-clavicular articulation: posteriorly, it is removed from the vertebræ by the longus colli muscle, the pleura, and some cellular tissue; finally, on the left, the par vagum runs by the side of it, and the serous membrane separates it from the lung until near the first rib: it is, therefore, much deeper seated than the arteria innominata.

The left subclavian artery ascends parallel to the preceding, from which it is separated by some cellular layers only; this branch lies so deep that it is almost in contact with the pleura in the summit of the thoracic cavity; so that its ligature, previous to its passage over the first rib, requires the greatest precautions relatively to the pleura.

Sect. 2. Of the Pectoral Cavities.

The left cavity is narrower than the right, on account of the inclination of the mediastinum and the position of the heart ; but it is more elongated, because the diaphragm does not ascend so high on the left as on the right. Each of these cavities possesses three parietes, one mediastinal, one diaphragmatic, and one costal ; they are filled by the lungs, but in such a manner that these organs descend more or less, according to the side which we examine, and several other circumstances. Thus, on the right side, the liver, in the natural state, keeps the diaphragmatic and costal parietes applied to each other to a level with the tenth rib. In forcible expirations, M. J. Cloquet has demonstrated that these two parietes might touch each other even as high as the sixth true rib ; so that the lung would not then be wounded by a weapon which would penetrate through one of the first five intercostal spaces (counting from below upwards) ; whilst, during inspiration, as the respiratory organ introduces itself between the ribs and diaphragm as far as the attachments of this muscle, it would always be injured in penetrating wounds of the chest. In the first case, the instrument would traverse the pleura twice, then the diaphragm and peritoneum, before it would reach the spleen or stomach in the left side of the belly, and the liver in the right ; in the second, the lung would be transfixed before the diaphragm is injured. Superiorly, in the summit of the thorax, the lung is separated from the supra-clavicular region merely by some cellular tissue and the pleura ; from the axilla, by the first rib and the internal surface of the four following ones : there, the space is narrower and rounded, in a well-formed subject ; it may be much more so, if the ribs are but little curved ; the respiratory organ then is, as it were, compressed between the upper part of the mediastinum, the vertebral column, and the costal paries.

The pleura which lines this paries sometimes presents, in fat persons, a kind of adipose appendages, which we should be careful not to confound with the sequelæ of previous inflammations. It is destined to favour the sliding of the lung, but sometimes becomes more or less adherent to this organ ; and in this case, the observations which we have just made, relative to the ascending

and descending movements of the lungs, are no longer applicable. The mechanism of the formation of these adhesions, which is at present better understood than formerly, deserves much attention, especially in relation to effusions. In fact, the costal and visceral sheets of the serous membrane of the thorax (*pleura pulmonalis et costalis*) may, in consequence of pleuritis, unite throughout their whole extent, and thus obliterate the cavity which separates them; but they may also be separated, to a certain extent, by the pus which has been secreted, whilst they are completely agglutinated throughout the remaining portions, and then the abscess will occupy either the inferior, superior, or posterior regions, or any other portion: wherefore, if we considered the operation for empyema necessary, we must not refer to the gravitation of the liquid and the dependent position of the thorax, in order to make an opening into this cavity.

The same thing may also happen, in consequence of penetrating wounds; but if the extravasation takes place before inflammation is developed and adhesions are formed, the fluid will generally collect in the sinuous cavities which separate the diaphragm from the ribs, or in the deep gutter which exists by the side of the spine, if the patient is recumbent on the back; that is to say, that the matters will then yield to the laws of gravity. Therefore, when the extravasation is sanguineous, we frequently observe a kind of stain, or ecchymosis, at the lower part of the dorsal and costal regions; a stain which Valentine considers as a diagnostic, but which is not always to be depended on.

If, on the contrary, the collection does not form until several days after the wound has been inflicted, the latter will still continue to correspond to the centre of the effusion; and, in this case, whenever pus fills the cavity, if the collection is small in quantity, or even when it is considerable, if it be sanguineous, we should take care how we make a counter-opening. Some modern surgeons, at the head of whom we must place Baron Larrey, consider these adhesions of great importance. They think that they convert these depositions into simple abscesses, and that the surgeon should reduce his therapeutics to the use of those means which will be most likely to favor the absorption of the effused liquids, by opposing, as much as possible, the admission of the

external air into these cavities, because this gas would confer upon the extravasated fluids irritating qualities, which would hinder them from passing into the general circulation.

When a wound penetrates into the pectoral cavity, and the lung is lacerated, if the division of the external parts is exactly parallel to that of the intercostal muscles, the air will escape outwards, and it is this phenomenon which gave rise to the precept of placing a lighted candle before a wound of the chest, in order to ascertain if it is penetrating. If, on the contrary, the openings of the different wounded organs do not correspond, the gas will pass into the cellular tissue and emphysema will follow. This emphysema is itself a disease which may become very serious, as is proved by the observations of Méry, Cleghorn, Hunter, etc. It sometimes extends throughout the whole body, and may swell the subject to an enormous size; which is owing to the communication which exists between all the cellular layers. Littre and M. Larrey have each related a very extraordinary example of this kind. We also conceive that if the pleura and lung are lacerated without the skin being divided, the emphysema will take place still more easily: hence, nothing is more common than this accident in fractures of the ribs, of which it constitutes one of the most certain signs; finally, if the lung is lacerated, notwithstanding the thoracic parietes have not been wounded, there will be in it an æriferous fistula and pneumo-thorax.

The pleura costalis, when diseased, sometimes acquires a considerable thickness, and that, in two different ways: in one, a greater or less number of albuminous layers are deposited and organized upon its internal surface; and this case appertains to pleurisies, properly so called, or depends upon a pulmonary affection. It would be useful to recollect the possibility of such a disposition, if we perform the operation of paracentesis for a collection of pus, in order that we may penetrate more deeply so as to reach the cavity; in the other, which generally coincides with an external disease of the thorax, it is the sub-pleural cellular tissue which becomes thickened, and produces in certain patients a layer resembling bacon (*une couche lardacée*), of a line or more in thickness. Here, it is a species of barrier which nature opposes to the progress of the disease, and upon which we should

calculate when we are obliged to operate upon the exterior of the chest ; a barrier which also repels the pus of deep seated abscesses towards the skin, and prevents them from opening internally. There are numerous facts in support of these assertions. We will mention but one, however, which we witnessed at the hospital of St. Louis in 1821. A man about thirty years of age had a large fistulous ulcer covered with vegetations, in the middle of the costal region, which had existed two years : one rib was carious, and M. Richerand was obliged to remove two inches of its length. This celebrated surgeon was apprehensive of penetrating into the serous cavity ; but the pleura formed a thick, hard and opaque wall, which permitted him to remove entirely the diseased portion of bone, and this laborious operation was attended with complete success. It is well known that a similar disposition existed in the subject from whom M. Richerand extirpated, by a bold operation, in 1818, several portions of the ribs together with a cancer.

By way of recapitulation : vulnerant bodies can only reach the heart, by traversing the chest perpendicularly to its axis, above the sixth rib. If they pass through the fourth intercostal space, a little to the left, they will fall upon the base of the right ventricle, or upon the left auricle ; on the right, they would wound the ventricle or auricle of this side ; by the third space, they would reach the trunk of the aorta or of the pulmonary artery, and the superior vena cava on the right ; by the second, they would divide the transverse portion of the arch of the aorta, or the principal branches which originate from it. If they should penetrate an inch and a half into the fifth space, at the union of the sternal and costal regions, they would strike the apex of the heart. If the instrument or weapon is directed from the costal region towards the median region posteriorly, it will hit against the bodies of the vertebræ, and wound the great sympathetic nerve or thoracic aorta. But it is proper to observe that these wounds are susceptible of pretty numerous variations, relatively to the separation of the ribs, which change the absolute length of the costal paries and of the pectoral cavity itself : thus, during a violent effort, all the intercostal spaces are enlarged ; it is the same in hydro-thorax. In pregnant women, dropsical individuals, new-born children, etc., we observe a contrary disposition, and the

internal organs must be affected in different points, notwithstanding those of the exterior are divided in the same manner. Diseases also occasion changes in the relative position of the organs, changes which affect the locality of the injured parts; so also do they occasion variations in the form of the chest and in the movements of the ribs; in hydro-thorax, for example, or any other effusion into one side only, if it is carried to a great extent, this side appears longer, more prominent and bulging than the other: when this effusion disappears, if the patient recovers, as the lung has been for a long time compressed by the fluid, it will not resume its natural volume, whence it follows that the thoracic paries goes, if I may so express myself, before it, and the chest thereby becomes contracted on the diseased side. M. Laennec has very satisfactorily explained the mechanism of this phenomenon, which then persists during life.

When acute pleurisy exists, whether there is effusion or not, as the pain prevents the contraction of the muscles, it follows that the ribs remain immoveable in the direction corresponding to the diseased pleura, and that the movements of expiration and inspiration are increased on the opposite side. If the lung becomes hepatized, if there is peripneumonia with or without costal pleurisy, the same thing may equally happen; and besides, the respiratory organ actually increases in volume and density, in consequence of the accumulation of fluids within it. In this case, the cavity which encloses it is, if I may so say, too small to contain it; and, as the ribs resist more than the soft parts which separate them, they apply themselves upon the external surface of the inflamed lung, producing as many grooves, more or less distinct, upon this organ. This last peculiarity, which was first pointed out by M. Broussais, and which is regarded by M. Laennec as a very difficult, if not impossible occurrence,* has presented itself twice to our observation.

The walls of the thorax are far from having the same thickness in all their points, in all ages or in all individuals: in children they are comparatively thin, on account of the absence of fat and the small size of the muscles; hence it follows that in early life they are much more sonorous than after puberty, and that if

* Auscultation médiate, etc., tome 1er, page 163.

we resorted to the method of Avenbrugger for exploring the chest, that is to say to percussion alone in order to establish the diagnosis of its diseases, we will often believe that the lungs are still permeable to the air, though their hepatization be complete ; but it is easy to rectify this error by means of the stethoscope.

In the sternal region, the walls are thin upon the median line, where the sternum is only covered by the skin ; they are also thin upon the sides, in its inferior half, where the cartilages are only separated from the integuments by the rectus abdominis muscles ; but, in general, very thick laterally in the superior half, on account of the mamma and pectoralis major muscle.

In the posterior region, they are extremely thick upon the median line, and even as far as the angle of the ribs, on account of the spinal column and the muscular masses which fill the vertebral gutters. Externally and superiorly, the shoulder renders them still thicker than elsewhere ; but below the axilla, and throughout the costal region, they are as thin as in the inferior part of the sternal region.

These data, important relatively to wounds of the thorax, are so likewise when we wish to employ percussion or apply the stethoscope to this cavity : then we should also recollect the exact relations which the contained viscera bear to the different regions of the surface. Thus, notwithstanding the spongy texture of the sternum, and the slight thickness of the soft parts, below the breast, in the sternal region, the chest is not very sonorous in these places, at least on the left, because these points correspond to the heart and principal vascular trunks. Auscultation therefore must here supercede percussion, in the examination of the affections of the central organs of the circulation. The clavicle, being never covered by very thick soft parts, and corresponding to the summit of the lungs, is one of the points which present the greatest advantages for percussion, which we apply in a much less certain manner to the anterior thoracic portion of the axillary region, especially in women and fat persons, on account of the mammæ. But this last situation may be perfectly explored by means of the cylinder, which equally gives more certain results, when placed upon the fossa supra-spinata, than the method of the celebrated German physician. In the posterior region, upon the lateral convexities, as the angles of the ribs are

only covered by thin muscles, and as these prominences correspond internally to the most spongy portion of the respiratory organs, we derive nearly the same advantages from percussion and auscultation: the same might be said in relation to the sides, if, on the right, the liver did not considerably diminish the sonorousness of the thorax, in the inferior part of the costal region; whilst on the left, the stomach, pushing up the diaphragm more or less, enables us generally to derive from percussion a very clear sound: which circumstances might induce us to believe, in the first direction, that the lung is impermeable, although it may be sound, and in the second, that this organ is in the natural state, when, on the contrary, it is more or less disorganized. In such cases we must also have recourse to the stethoscope, in order to avoid error, and this instrument may be easily applied to all the points of the costal region, even as high as the third intercostal space, if we take the precaution to elevate the arm.

Sect. 3. Base of the Thorax.

This part, which we might call the diaphragmatic region or wall of the chest, is the most moveable and most variable in the normal state. Formed entirely by the superior surface of the diaphragm, it is greatly elevated during expiration, and more or less depressed when the lungs are distended with air. In the first case, the muscle represents two rounded eminences, which ascend in the thoracic cavities, a little higher on the right side than on the left, and sometimes to the seventh or sixth rib. In this state, those physiologists who think that the lungs dilate and contract in a passive manner, suppose that the diaphragm is in contraction, and that it is this muscle which expels the air. But it is evident that the effect is here taken for the cause, and that this fleshy membrane merely follows the lungs, in proportion as the gaseous fluid escapes from them by their proper action.

In the second, it actually contracts, although it may also sink mechanically; its fibres straighten themselves; it pushes the abdominal viscera downwards, forwards, and slightly towards the right, because it is inclined in such manner as to look a little in this direction: it is even to this slight inclination of the diaphragm that we may attribute the greater frequency of herniæ

on the right side. It is especially when we make any great exertion that it contracts in a decided manner; then it draws upon the ribs to which it is attached, tends to diminish the circle which they form, and maintains them more or less solidly fixed; so that all the other muscles of the body may here find a solid point, either by their direct attachments, or by their actions being conveyed to it through the medium of some other muscles. On the other hand, the epiglottis hermetically seals the larynx, in order that the lungs, distended with air, may exactly fill the cavity of the chest, and keep its walls suitably separated.*

This region presents three portions, which should be distinguished in relation to their functions: we find in the first place, the two lateral portions, completely lined by the pleura, naturally more convex on the right than on the left, inclined backwards and upon the sides, and which correspond to the muscular portion properly so called: it is to these two portions that we must refer what has just been said respecting the actions of the diaphragm; they constitute the internal wall of the sinuous prolongation of each cavity of the thorax, the vertical diameter of which they alternately elongate and diminish. Their disposition, moreover, is such, that this axis or diameter is shorter anteriorly than posteriorly and laterally.

The middle portion corresponds to the central aponeurosis, and supports the heart; it is enclosed in the mediastinum, and presents anteriorly, behind the xiphoid cartilage, the cellular communication which exists between the abdomen and thorax; more posteriorly, the two pleuræ, which are very close, but not completely applied to each other. Next comes the great circular portion, entirely fibrous, from the circumference of which the pericardium seems to originate, and which is perforated on the right by an irregularly square foramen, through which the inferior vena cava passes; so that this vessel cannot be compressed in any manner by the contractions of the diaphragm; more posteriorly still, the pleuræ again approximate, and are even in contact upon the fore part of the œsophagus, which is considerably inclined to the left; finally, we find in the diaphragmatic

* M. Isidore Bourdon. Mémoire cité.

extremity of the posterior separation of the mediastinal septum, a *hiatus* for the transmission of the aorta, through which the thoracic duct also passes, in the same way that the *nervi vagi* penetrate into the belly by the œsophageal aperture; the great and lesser splanchnic nerves, which result from the union of six or seven filaments derived from the last corresponding ganglions of the great sympathetic. This portion of the diaphragmatic wall is almost immoveable when the lateral parts are elevated or depressed; and we conceive that, if it had been otherwise, the action of the heart would have been disturbed at every instant. It is almost plane, being but slightly inclined from before backwards and from above downwards: whence it follows that the posterior mediastinal space is longer than the anterior.

Sect. 4. Summit of the Thorax.

It comprises the superior opening of the chest and the numerous organs which traverse it. The osseous circle has the form of an ellipse, the posterior part of which seems as if it had been forcibly pushed towards the anterior. It is constituted, anteriorly, by the supra-sternal notch, which is rendered much deeper by the prominence which the clavicles form upon the sides; posteriorly, by the body of the first dorsal and of the seventh cervical vertebræ; externally, by the concave margin of the first rib. We may observe that this opening is neither upon an even nor horizontal plane. Its anterior notch makes it appear more or less elevated posteriorly; so that several organs deeply situated in this direction are already in the thorax, whilst, more superficially, they would still be in the infra-hyoideal region. On the outer side of the median line, the sterno-clavicular articulation gives to it a greater elevation, and thus affords greater protection to the important organs which are situated behind it. Upon the sides, it is again depressed, on account of the inclination outwards of the superior aspect of the ribs.

Let us now examine the order of superposition of the organs, and their relative dispositions in the summit of the chest: by comprising in it the constituent parts, we find;—1st the skin; 2d, the sub-cutaneous cellular and fibrous layer; 3d, the top of

the sternum, the origin of the sterno-mastoid muscle, the inter-clavicular ligament, the sterno-clavicular articulation, the costo-clavicular ligament, the cartilage of the first rib, and the termination of the two laminæ of the *fascia cervicalis*: this plane is completed posteriorly by the origin of the sterno-hyoid and sterno-thyroid muscles, which descend as far as on a level with the first intercostal space, behind the sternal notch and the articulation; 4th, a thin, but pretty dense cellular layer; upon the same plane, on the left, the subclavian vein and the terminations of the internal and external jugulars; in the middle, the subclavian vein still, the termination of the thyroideal veins, the thymus; on the right, the junction of the left and right subclavian veins, and of the internal and external jugulars, in order to form the superior vena cava; 5th, a very compact fibro-cellular layer, which separates the veins from the arteries; behind this layer, and from right to left, the termination of the arteria innominata, the origin of the common carotid and subclavian arteries, very close to the bones; the internal mammary, which runs towards the posterior surface of the sternum, accompanied by its two veins; the thyroid artery of *Neubauer*, when it exists; the vertebral, when it originates from the aorta; the left carotid; more deeply, the subclavian, giving off the internal mammary of this side; the paravagum and phrenic nerves placed, on the right, before and a little to the outer side of the arteria innominata; on the left, before, and somewhat remote from the subclavian artery; 6th, the body of the trachea, enveloped in a dense and compact fibro-cellular tissue; externally, some lymphatic glands, the recurrent nerves; 7th, the œsophagus, in the middle, and slightly passing beyond the trachea on the left; externally, numerous filaments of the great sympathetic nerve; the origins of the vertebral, superior intercostal and transverse cervical arteries; their collateral veins; 8th, the longus colli and scalenus anticus muscles, which leave between them a triangular space with its base downwards, in which we see the vertebral artery and vein, a nervous plexus derived from the great sympathetic, and this nerve itself; under the head of the rib, the inferior cervical ganglion; 9th, lastly, the bodies of the vertebræ, less prominent, but of rather greater transverse extent than in the chest prop-

erly speaking; the first costo-vertebral articulation; sometimes a costiforme prolongation, which surmounts the transverse process of the seventh vertebra of the neck; the first rib and the anterior branch of the first dorsal nerve, which goes to unite with the last of the cervical region.

From this simple enumeration, it is easy to foresee the danger arising from wounds penetrating into the summit of the chest, and how it is that fluids extravasated or accumulated in the middle and lateral regions of the neck, may extend behind the sternum, before the spine, or follow the vessels, and diffuse themselves in the anterior and posterior mediastinal spaces without penetrating into the cavities of the pleuræ. We can also conceive the symptoms which may arise from the exostoses occasionally produced by syphilis upon the fore part of the vertebræ, and which still more frequently grow from the clavicle and even the sternum; from luxations of the clavicle backwards, when they exist; in short, from tumours of any kind, by the pressure which they would exercise upon the trachea, œsophagus, veins, arteries or nerves.

If we now take up the consideration of the order of superposition of the parts in another point, we will find some differences, with which the surgeon should be well acquainted. Immediately above the heart, for example, which corresponds to the first two intercostal spaces and the upper piece of the sternum, we find, 1st, the skin; 2d, the cellulo-adipose layer, a fibro-cellulous lamina, the pectoralis major muscle; 3d, the sternum, the cartilages, the intercostal muscles, including the external branches of the internal mammary artery; the trunk of this artery coated by two veins, and enveloped by a cellular layer which separates it from the pleura; 4th, in the middle, the superior triangle of the anterior separation of the mediastinum, filled by cellular tissue, lymphatic glands and fat; the pleura upon the sides; 5th, a prolongation of the pericardium, and of the thymus in children; 6th the superior vena cava and the azygos, which turn over the right bronchus; the trunk of the aorta and its transverse arch; the origins of the arteria innominata, left carotid and left subclavian arteries; the pulmonary artery, at first before the aorta, afterwards behind it and to the right; its

two branches and the remains of the ductus arteriosus, which unites the left pulmonary artery to the aorta, below the curvature of the latter; the phrenic nerve, upon the aorta on the left, the vena cava on the right, and upon the fore part of the root of the lungs, on both sides; the nerves of the eighth pair, disposed like the phrenic, except that they pass behind the pulmonary roots; the cardiac ganglion, placed between the transverse arch of the aorta and the pulmonary arteries; the nerves which this ganglion receives and the plexus which depart from it; some fibro-cellular tissue, continuous with the pericardium and the vascular sheaths of the neck; 7th, the auricles and pulmonary veins; the termination of the trachea and the commencement of the bronchi; next, the root of the respiratory organs, which is composed from before backwards and from below upwards, of the phrenic nerve, the veins, the arteries, the first division of the bronchi, the plexus of the par vagum; 8th, the bronchial vessels, the œsophagus, thoracic duct, the vena azygos before it rises upon the right bronchus; the commencement of the thoracic aorta, after it has turned over the left bronchus; 9th, the intercostal arteries and veins, the venæ azygos and demi-azygos; the great sympathetic nerve; 10th, and lastly, the vertebral column, covered by the origin of the longus colli muscle, and the ligamentous parts.

Still lower these relations are less complex. Behind the sternum, we see: 1st, the inferior triangle of the sub-sternal separation of the mediastinum, an abundance of cellular tissue; 2d, the pericardium, formed of two laminæ in the middle, and of three at the sides, on account of the pleura which is applied to it; 3d, a space which separates the heart from its envelope; 4th, the apex of the heart, its right ventricle, the auricles: the right more anteriorly, the left more posteriorly; 5th, the left ventricle, the posterior part of the auricles, the termination of the pulmonary veins and inferior cava; 6th, another space, which separates the heart from the pericardium behind; 7th, the pericardium, disposed as anteriorly; 8th, the approximated pleuræ; 9th, the œsophagus and nervi vagi; 10th, the aorta, &c.

When the viscera of the thorax are removed, its cavity presents four portions or regions. The anterior is inclined forwards, or ra-

ther it forms a curve, the concavity of which looks backwards and downwards: at puberty it elongates more than either of the others; which is owing to the rapid developement of the sternum at this epoch. The posterior wall is much longer, and proportionally still more so in infancy than in the adult, because the vertebral column which forms it is already very long at birth, whilst the sternum, on the contrary, is very short: whence it follows that the abdomen then seems to have considerable dimensions anteriorly, whilst posteriorly the relations of this cavity with the chest are nearly the same that they always are. This wall is concave before, and not simply inclined backwards. As it is formed, 1st, by the bodies of the dorsal vertebræ upon the median line, it there represents a sort of rounded crista, which actually constitutes the posterior part of the mediastinal septum; 2d, by the angular portion of the ribs upon the sides, where there are two deep gutters in which the lungs principally are lodged: But these peculiarities are more striking towards the adult period, and in well-formed subjects. In very young children, in fact, the bodies of the vertebræ seem to be thrown backwards, because the angle of the ribs is not yet developed. Sometimes this disposition persists after puberty, in which case the lungs, less free, are impeded in their motions, and more disposed to chronic diseases. The chest appears narrow in these persons; the shoulders project backwards and the sternum forwards; so that the central organs of the circulation move more freely, on account of the enlargement of the antero-posterior diameters of the thoracic cavity.

The lateral wall is the longest; posteriorly, it is concave transversely, and in a regular manner also, from above downwards, in many subjects, among others in those females who are in a habit of wearing tight corsets.

In consequence of the difference in the curvature and length of the thoracic parietes, the base and summit of this cavity are inclined in opposite directions, that is to say, that the superior aperture is depressed, whereas the inferior is raised, in the same manner as the two straits of the pelvis; so that a line, dropped perpendicularly in the centre of the former, would fall upon the base of the dorsal column, and that, if this line was let fall from

the centre of the second, it would strike upon the body of the first vertebræ of the back. It also follows that the vertical axis of the chest is oblique from above downwards, from behind forwards, and even from left to right, on account of the lateral curvature in the middle of the dorsal column. With respect to the transverse dimensions, they increase in a prompt and gradual manner as far as the seventh rib ; in descending afterwards, they also enlarge, but slightly ; in some persons they remain the same as they were higher up ; and in others, they are diminished in a very striking manner.

END OF THE FIRST VOLUME.

EXPLANATION OF THE PLATES.

VOL. I.

PLATE I.

FIGURE 1, *Representing the Anterior Regions.*

- 1 1 Frontal Regions, viewed in front, separated from each other
by the median line.
- 2 2 Parietal,
- 5 5 5 Orbital,
- 4 4 4 4 Parotideal,
- 6 6 6 Masseteric,
- 7 7 Nasal,
- 8 8 8 Zygomato-Maxillary,
- 9 9 9 Genial,
- 37 37 Labial,
- 38 38 Mental,
- 10 10 10 Supra-Hyoidal,
- 11 11 Infra-Hyoidal,
- 12 12 Supra-Clavicular,
- 40 40 Sub-Clavicular,
- 41 41 Anterior Brachial,
- 42 42 Regions of the Fold of the Arm.
- 43 43 Anterior Anti-Brachial Regions.
- 44 44 Anterior Regions of the Wrist.
- 45 Palmar Region of the Hand.
- 21 21 Sternal Region.
- 23 23 Epigastric.
- 24 24 Umbilical.
- 25 25 Hypogastric,
- 39 39 Pubic,
- 46 46 Inguinal Regions,
- 28 28 Anterior Crural,
- 29 29 29 Regions of the Kneec.
- 47 47 Anterior Regions of the Legs.
- 31 31 31 External Tibial Regions.
- 48 48 Internal Malleolar.

FIG. 3, *Representing the Posterior Regions.*

- 3 3 Occipital Regions.
 13 13 13 Posterior Region of the Neck. In order to study this region, the reader should make an abstraction of the perpendicular line which divides this region into two.
 14 14 14 Posterior Region of the Shoulder.
 15 15 15 15 Posterior Brachial Regions.
 16 16 16 16 Region of the Elbow.
 17 17 17 17 Posterior Anti-Brachial Regions.
 18 18 18 18 Posterior Regions of the Wrist.
 19 19 19 19 Dorsal Regions of the Hand.
 35 Dorsal Region of the Thorax.
 36 Lumbar Region.
 20 20 20 20 20 Costal Regions and Hypochondria.
 22 22 22 22 22 Regions of the Flanks.
 26 26 26 26 26 Gluteal Regions.
 27 27 27 27 27 Posterior Crural Regions.
 30 30 30 30 30 Popliteal Regions.
 32 32 32 32 32 Posterior Regions of the Leg.
 33 33 33 33 33 External Malleolar Regions.,
 34 34 34 34 34 Dorsal Regions of the Foot.

FIG. 2. *The same numbers indicate the same regions viewed laterally*

PLATE II.

This Figure represents a vertical section of the head and of the anterior wall of the larynx, but in such a manner that the latter is reflected upon the right side, so as to present itself in front.

- 1 Portion of the Cranial Cavity.
- 2 Fossa Cerebelli of the Cranium, lined by the dura mater.
- 3 Portion of the Tentorium Cerebelli, raised by a hook.
- 4 Prolongation of the medulla in the spinal canal.
- 5 Sphenoidal Sinus, in which we see the extremity of a stylet, and which communicates in the superior meatus of the nasal fossæ.
- 6 Frontal Sinus, equally containing a stylet, and opening into the middle meatus.
- 7 Superior Cornet,
- 8 Middle or Ethmoidal do. } (*Turbinated bones*)
- 9 Maxillary or inferior do. }
- 10 Superior meatus, leading into the sphenoidal sinus
- 11 Middle meatus, broader anteriorly, narrower posteriorly, where it no longer forms but a gutter, which conducts into the upper part of the pharynx, above the Eustachian trumpet. It is in this meatus that the orifices of the frontal and maxillary sinuses are observed, each traversed by a stylet.

- 12 Inferior meatus.
- 13 Stylet introduced into the sinus of the sphenoid.
- 14 Another stylet which has passed through the entire length of the external wall of the inferior meatus, in order to place itself in the guttural canal of the ear.
- 15 Third stylet, engaged in the antrum of Hygmore: we may perceive that the opening of this sinus seems to be situated in a species of excavation, and more approximated to the middle than to the inferior cornet.
- 16 Fourth stylet which ascends into the frontal sinus by the middle meatus.
- 17 The fifth, engaged in the nasal canal, under the anterior part of the maxillary cornet, where is observed a kind of infundibuliform depression.
These last four stylets are enclosed in the left aperture of the nose, the lobule of which is preserved, as well as the pedicle which fixes it to the nasal spine.
- 18 Stylet introduced into the Parotid duct by its buccal orifice, opposite to the interval which separates the third from the fourth molar tooth.
- 19 Interior of the pharynx, which curves upwards and forwards, in order to continue itself with the nasal fossæ: its right half is reflected backwards and downwards, in order to show the posterior wall.
- 20 Pharyngeal orifice of the Eustachian trumpet.
- 21 Left half of the uvula, drawn downwards and forwards by a hook, in order to render the pillars of the velum palati tense.
- 22 The Tonsil.
- 23 Posterior or pharyngeal pillar of the velum palati.
- 24 Lingual or anterior pillar.
- 25 Vertical section of the palatine vault.
- 26 Left portion of the palatine cavity.
- 27 Internal wall of the left cheek, presenting, posteriorly, the anterior border and a portion of the internal face of the coronoid apophysis of the lower jaw, enveloped by the mucous membrane.
- 28 Left half of the dorsum of the tongue, slightly drawn forwards and inclined to the right.
- 29 Perpendicular section of the inferior maxillary bone and of the parts which compose the supra-hyoid region upon the median line: this section prolongs itself upwards with that of the tongue, and downwards with that of the anterior part of the larynx, the right half of which is drawn backwards.
- 30 Inferior part of the pharyngeal cavity, at the moment when it passes behind the arythenoid cartilages, in order to continue itself with the œsophagus.
- 31 31 Great Cornua of the thyroid cartilage.

- 32 32 Ventricles of the larynx, circumscribed by the inferior and superior cordæ vocales.
 33 Interior of the Laryngeal cavity.
 34 34 Hooks which keep separate the two halves of the larynx, in order to show the internal surface.
 35 Inferior portion of the neck.

PLATE III.

This figure represents the fore part of the neck, separated from the head and the thorax: it is relative to the details of the infra-hyoidal region.

- 1 1 Reflected flap of the subcutaneous layer, continuous by its base with the similar layer of the supra-hyoidal region.
 2 2 Another portion of the teguments, likewise reflected.
 3 3 3 Superior and lateral parts of the neck, and the commencement of the head, in the natural state.
 4 Left Sterno-mastoid Muscle, reflected outwards by (5) a hook, in order to expose the organs which it covers.
 6 Right Sterno-mastoid Muscle, in its natural position, or slightly drawn outwards.
 7 Sterno-hyoid Muscle.
 8 Sterno-thyroid Muscle.
 9 Omo-hyoid Muscle.
 10 Internal Jugular Vein.
 11 Common Carotid Artery.
 12 External Carotid Artery.
 13 Internal Carotid Artery.
 14 External Jugular Vein, or rather, anterior jugular vein in-osculating with the internal jugular vein towards the middle of its length, and following the internal margin of the sterno-mastoid muscle.
 15 Descending branch of the hypoglossal nerve (*descendens noni*), a little nearer the median line than usual, in this subject.
 16 Pneumo-gastric nerve (*par vagum*), which communicated here with the ramus descendens noni, and of which one branch passed transversely between the primitive carotid artery and the omo-hyoideus muscle.
 17 Inferior Thyroid Veins.
 18 Superior Thyroid Arteries.
 19 Crico-thyroid branch, furnished by the preceding artery.
 20 Another branch of the superior thyroid, and which penetrates into the thyroid gland, by passing upon the anterior face of the cricoid cartilage.
 21 Thyroid Cartilage.
 22 Crico-thyroid membrane.
 23 Cricoid Cartilage, covered by its two small muscles.
 24 Thyroid Gland slightly developed.

- 25 Trachea-Arteria.
- 26 Anterior Jugular Vein, enclosed by the laminæ of the deep sheet of the cervical aponeurosis, which conceals on this side the sterno-hyoid and sterno-thyroid muscles, and which passes behind the sterno-mastoid.
- 7 9 4 14 Omo-tracheal triangle, limited above by the scapulo-hyoid muscle; below by the sterno-mastoid; internally, by the sterno-hyoid and the trachea-arteria, and in which we may tie the primitive carotid artery.
- 4 9 18 Omo-hyoid triangle, circumscribed by the sterno-mastoid externally; by the omo-hyoideus internally; by the os hyoides superiorly, and in which we may easily apply a ligature upon the common, internal, and external carotid arteries, and the superior thyroid.

PLATE IV.

In order that the objects represented in this figure may be fully comprehended, it is necessary to remark, that the shoulder is firmly depressed, in order to place in view the subclavian vessels, and that all the parts are in the position which is given them, when about to practise the ligature of the subclavian artery.

- 1 1 Occiput thrown a little backwards.
- 2 2 2 Flaps of skin lined by its subcutaneous layer, raised behind the ear, and turned down upon the fore part of the chest.
- 3 Lobule and part of the pavilion of the ear.
- 4 4 4 Perpendicular section of the skin upon the posterior limits of the region.
- 5 5 Section of the clavicular portion of the trapezius muscle.
- 6 Commencement of the shoulder.
- 7 7 7 7 Sterno-Mastoid Muscle, showing between its two roots a small excavation which corresponds to the brachio-cephalic trunk.
- 8 Flap of adipo-cellular tissue, preserved upon the external face of the preceding muscle, and traversed by the two nervous branches of the cervical plexus, which go to the fore part of the neck.
- 9 10 Splenius Cervicis and Lev. Ang. Scapulæ muscles.
- 11 11 Scalenus posticus muscle, formed of two bundles.
- 12 Scalenus anticus muscle.
- 13 13 Omo-hyoideus muscle.
- 14 Subclavian Artery on the outer side of the scalenus anticus.
- 15 Termination of the internal jugular vein.
- 16 Termination of the subclavian vein.
- 17 External jugular vein, reflected and drawn down with the integuments.
- 18 18 Acromio-clavicular, or principal vein of the shoulder.
- 19 Small anomalous muscle, forming an arch, fixed by its two extremities to the clavicle.

- 20 Ascending cervical artery.
 21 Internal mammary artery.
 22 22 Posterior scapulary artery.
 23 23 23 Nerves of the Brachial Plexus.
 24 Supra-clavicular branch of the cervical plexus.
 25 Phrenic Nerve.
 26 Spinal Nerve, confounded with a branch of the cervical plexus.
 27 27 27 Sub-mental branches of the cervical plexus.
 28 Sub-mastoid Nerve, or posterior auricular of the cervical plexus.
 29 Spinal Nerve, which passes behind the sterno-mastoid, instead of traversing it.
 30 Portion of the grooved director (*sonde cannelée*), which raises the subclavian artery, 14, on the outer side of the scalenus anticus, upon the first rib, depressing the supra-clavicular nerves.
 31 *Sonde Cannelée*, introduced under the same artery, between the origin of the internal mammary, vertebral and ascending cervical branches, on the one part, and the internal border of the scalenus anticus, on the other.
 32 The same instrument, passed under the common trunk of the thyroid and ascending cervical arteries, and also raising the phrenic nerve.
 2 13 13 19 7 *Omo-clavicular Triangle*, limited by the omo-hyoideus and sterno-mastoid muscles, and the clavicle.
 4 4 4 7 7 27 27 13 13 *Omo-trapezium Triangle*, circumscribed by the sterno-mastoid, trapezius, and omo-hyoideus muscles.
 22 *Omo-clavicular Triangle*, divided into two portions by the scalenus anticus muscle.

PLATE V.

In this figure the arm is slightly removed from the trunk; the skin, the subcutaneous layer, the cellular tissue and the lymphatic glands are removed.

- 1 Portion of the internal face of the arm.
 2 Hairs of the axillary excavation.
 3 3 3 3 3 Limits of the region.
 4 4 Flaps of the pectoralis major muscle, one externally upon the fore part of the deltoid, the other internally and inferiorly upon the chest.
 5 Pectoralis minor muscle.
 6 Anterior portion of the deltoid muscle.
 7 Subclavius muscle.
 8 Coraco-brachialis muscle.
 9 Lateral portion of the thorax.
 10 Anterior part of the clavicle.

- 11 Coraco-clavicular aponeurosis, covering the subclavius muscle: we only see here the internal and superior portion of this aponeurosis, the rest having been removed in order to expose the vessels and nerves to view.
- 12 *Sonde Cannelée* raising the axillary artery at the place where we should apply the ligature upon the vessel in the clavipectoral triangle.
- 13 13 Axillary Vein.
- 14 14 Cephalic.
- 15 15 Axillary Artery.
- 16 16 16 Median Nerve and its two roots which embrace the artery.
- 17 17 Musculo-cutaneous nerve, running along the internal border of the coraco-brachialis muscle, from which a slice has been removed parallel to the fleshy fibres in order to give a better view of the nervous cord.
- 18 18 Ulnar Nerve, still very close to the artery.
- 19 19 Internal cutaneous, separated from the preceding by the axillary vein.
- 20 Posterior Thoracic Nerve, concealed in great part by the shadow, in the bottom of the cavity, and applied upon the serratus magnus anticus muscle.
- 21 21 Brachial branches of the intercostal nerves.
- 22 22 22 Acromial artery, originating from the axillary behind the pectoralis minor, and being discovered only upon the forepart of the vein.
- 24 *Coraco-acromion Ligament*, sliding under the deltoid muscle.
- 25 25 *Coraco-acromion* triangle.
- 26 Small arterial and venous branches of the hollow of the axilla.
- 27 Head of the Humerus.
- 5 3 25 Clavipectoral triangle, limited by the pectoral muscle below and by the clavicle above.
- 24 25 25 Coraco-acromion triangle, limited by the coraco-clavicular and coraco-acromion ligaments.
- 24 14 3 3 5 Subpectoral triangle, circumscribed by the humerus externally, the pectoralis minor muscle superiorly, and the anterior margin of the axilla inferiorly.

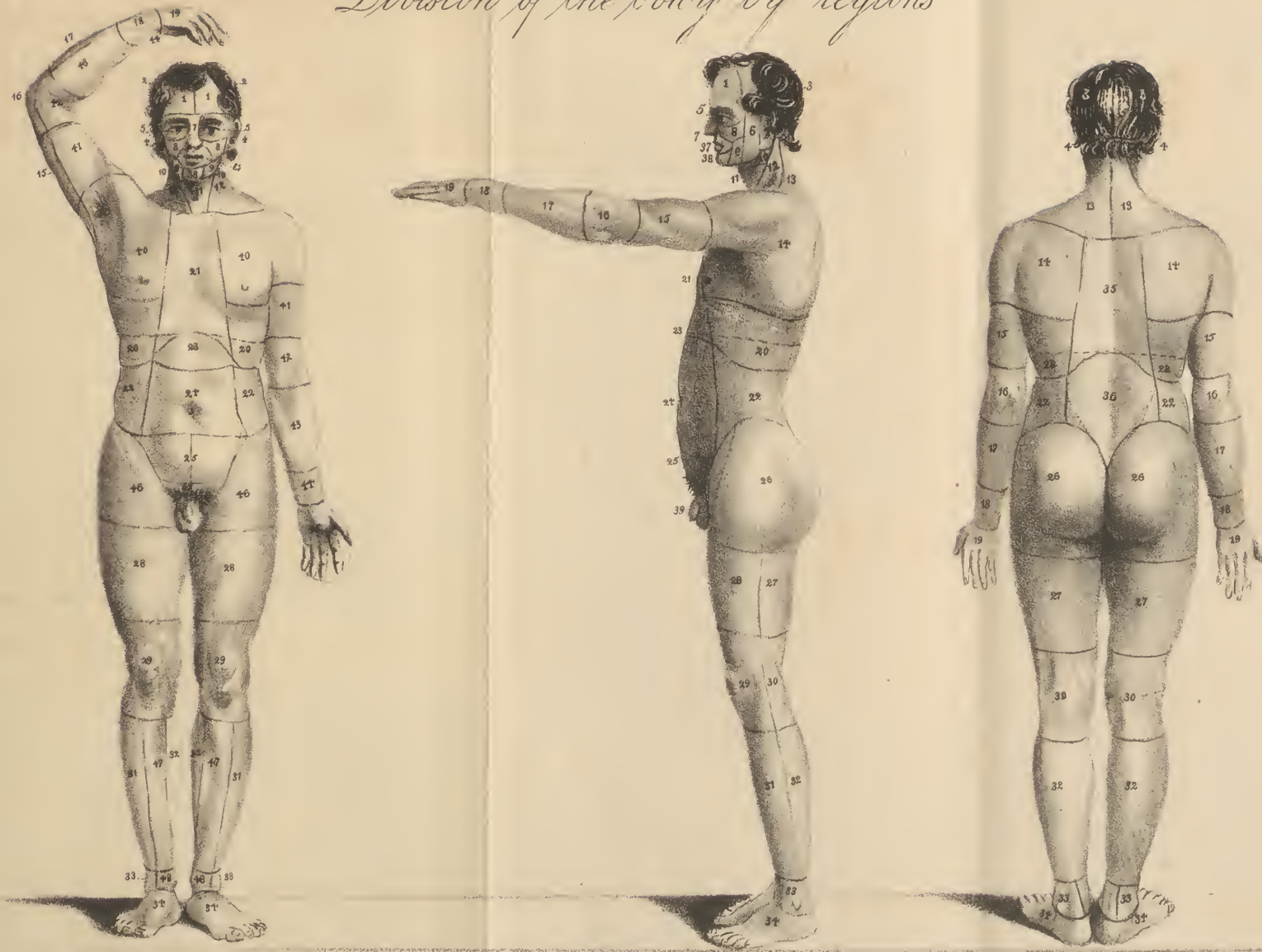
PLATE VI.

This figure represents the fold of the arm in such a manner as to show the disposition of the organs which may be concerned in the operation of Venesection, etc.

- 1 Trunk of the Basilic vein in the internal bicipital-gutter or groove
- 2 Cephalic vein on the external side of the biceps, and separated from the musculo-cutaneous nerve by the aponeurosis.
- 3 3 Basilic and cephalic veins of the fore arm, or anterior radial and ulnar branches.
- 4 *Sonde Cannelée*: placed under the humeral artery, above the fibrous bandelet of the biceps.

- 5 Common median vein, which communicates with the deep veins, in passing before the aponeurotic aperture, and which afterwards divides in order to form the median basilic and median cephalic.
- 6 Posterior ulnar vein.
- 7 Posterior radial.
- 8 Trunk of the internal cutaneous nerve, placed on the inner side of the basilic vein.
- 9 Musculo-cutaneous nerve, distributing itself especially around the common median vein.
- 10 Aponeurotic bandelet which is detached from the bicipital tendon in order to pass upon the fore part of the internal muscular mass.
- 11 Tendon of the biceps muscle.
- 12 12 12 12 12 Circumferences of the aponeurotic aperture of the elbow, strong and distinct internally, thin and blending itself externally with the cellular tissue which covers the external muscular mass.
- 13 13 Brachial Artery.
- 14 Radial Artery.
- 15 Cubital artery, or ulnar.
- 16 Median nerve.
- 17 17 Brachial vein; these last two organs, here separated from the artery by the *sonde*, rest upon the brachialis internus muscle before insinuating themselves between the fibrous bandelet of the biceps and the tendon of this muscle.
- 18 20 20 External muscular mass.
- 19 19 19 Internal muscular mass, covered in great part by the aponeurosis.
- 21 Internal eminence of the elbow or epitrochlea.
- 22 Hook which draws inwards the aponeurotic aperture, in order to expose to view, above the bandelet of the biceps, the brachial artery and vein, the median nerve, the brachialis internus and pronator teres muscles.
- 23 23 Subcutaneous layer and portion of the reflected skin.
- 24 Fore arm covered by its integuments.
- 25 Inferior part of the arm likewise covered by the skin

Division of the body by regions



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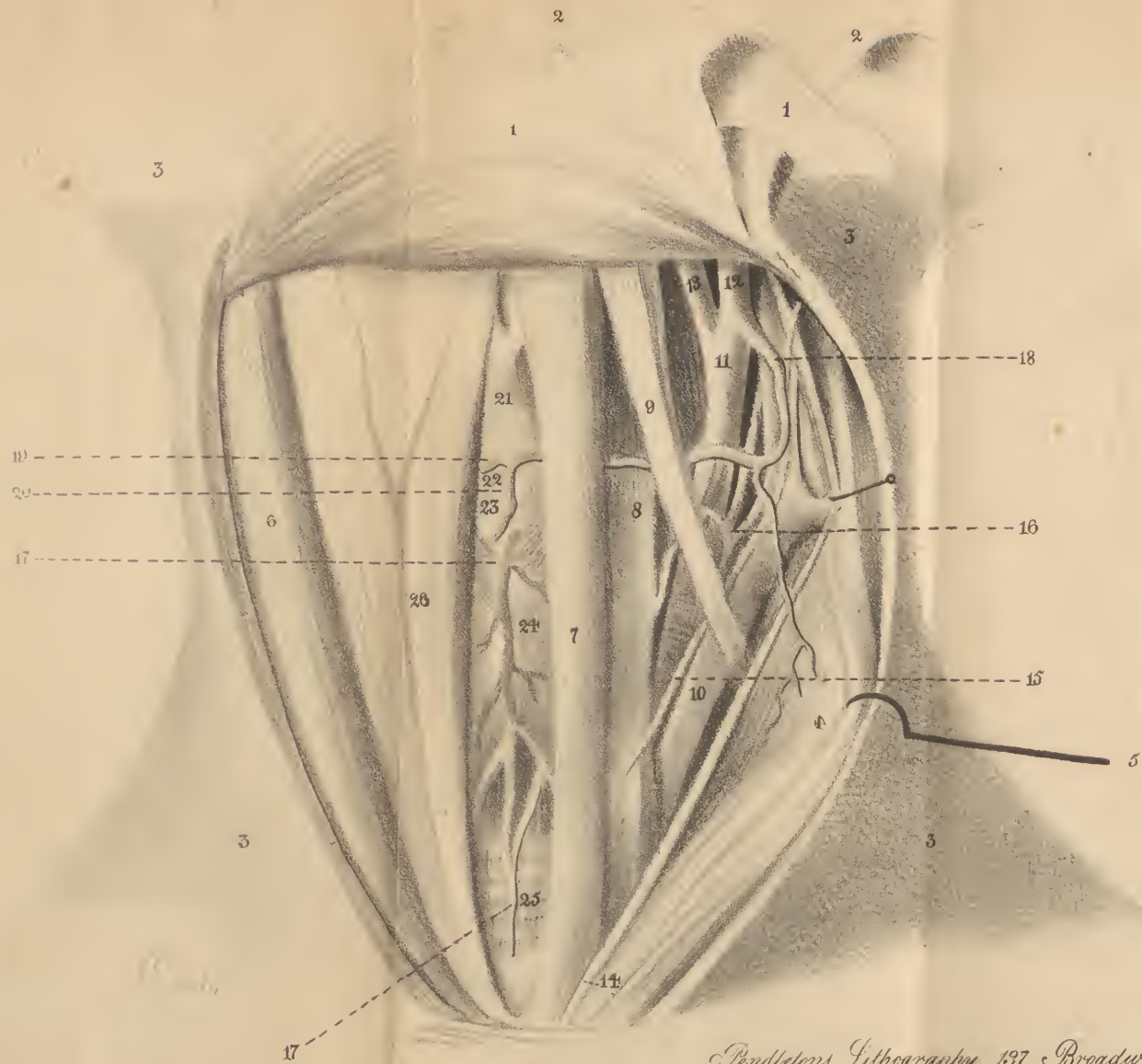


Vertical Section of the Head



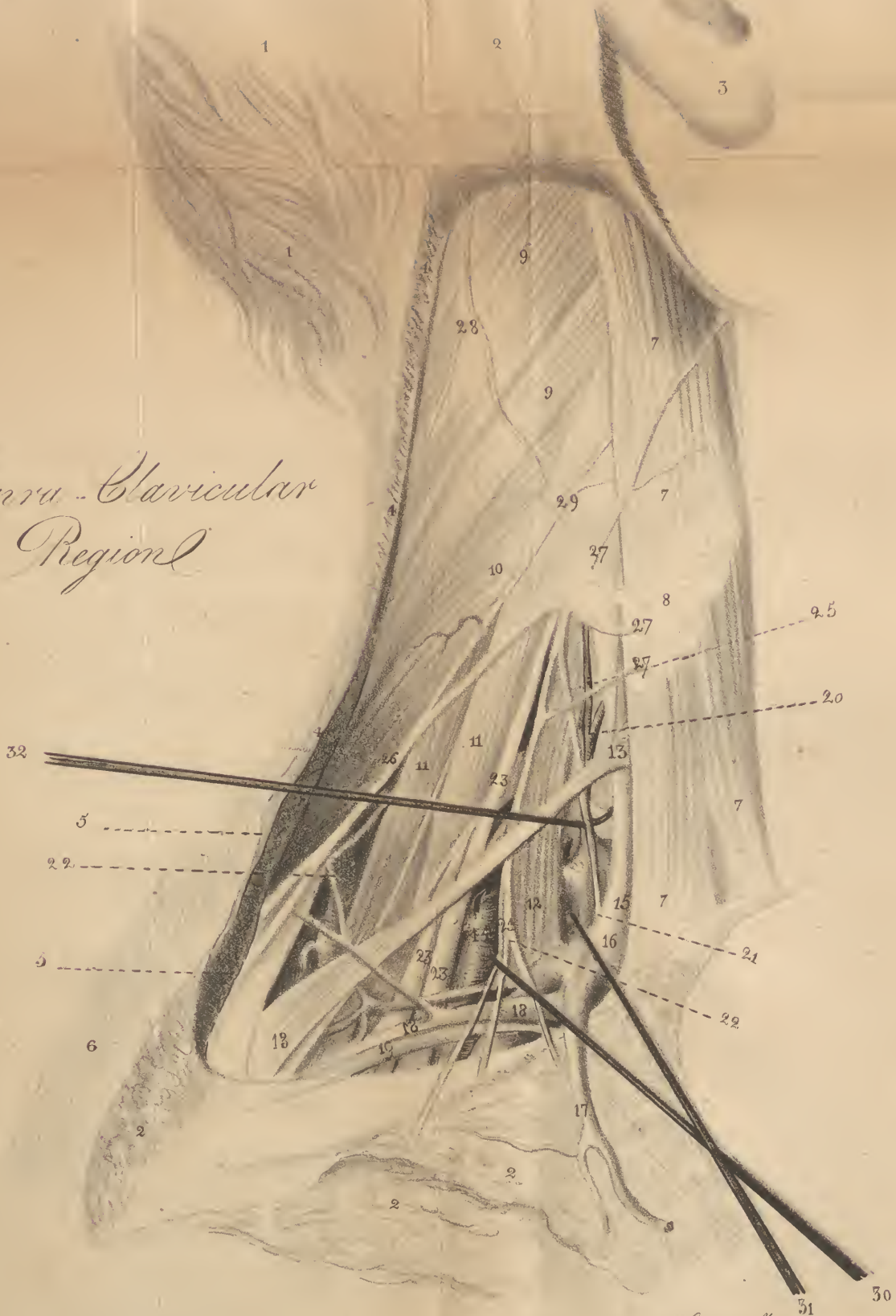
Pl. 3.

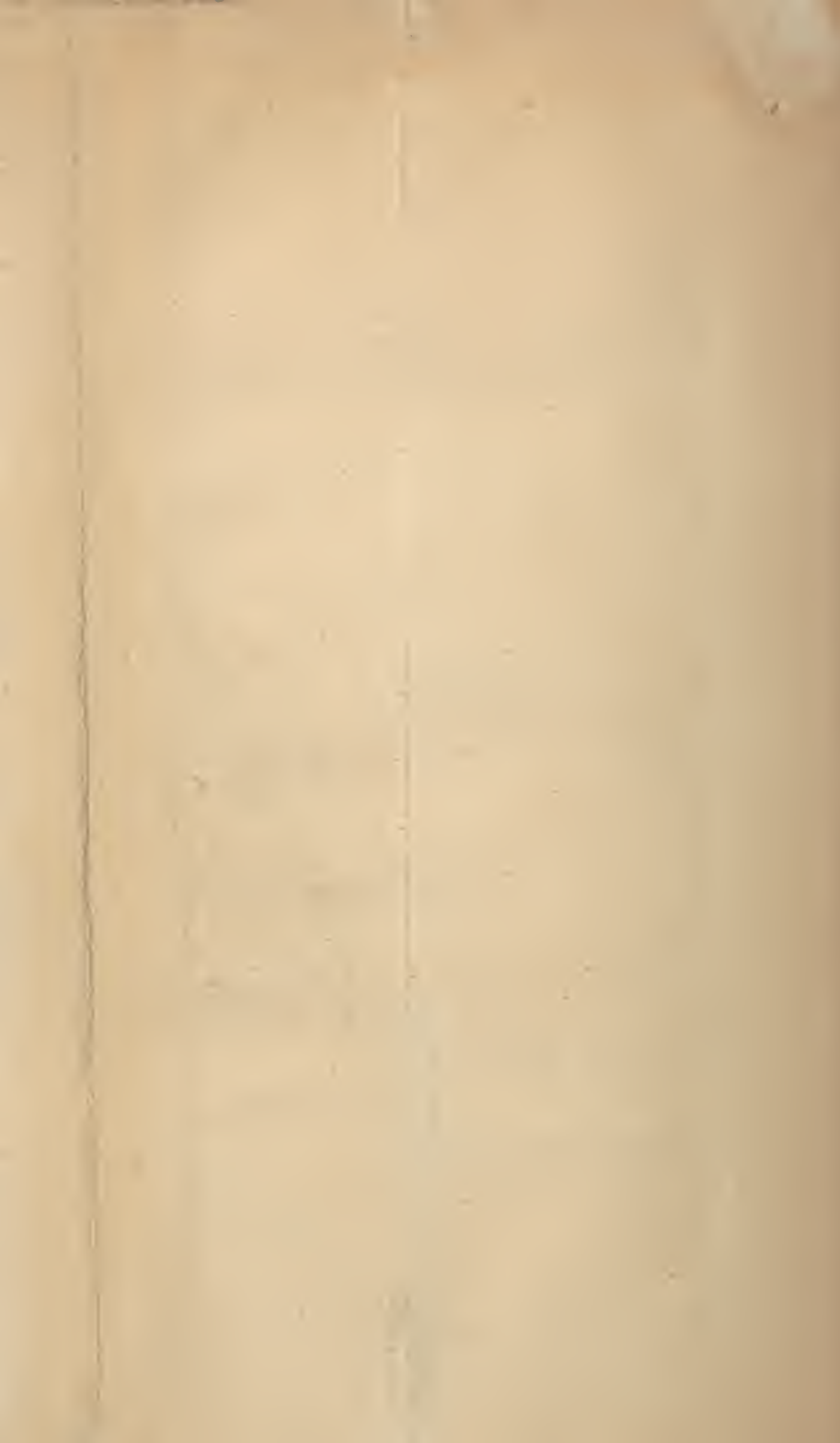
Sub-Hyoidal Region.



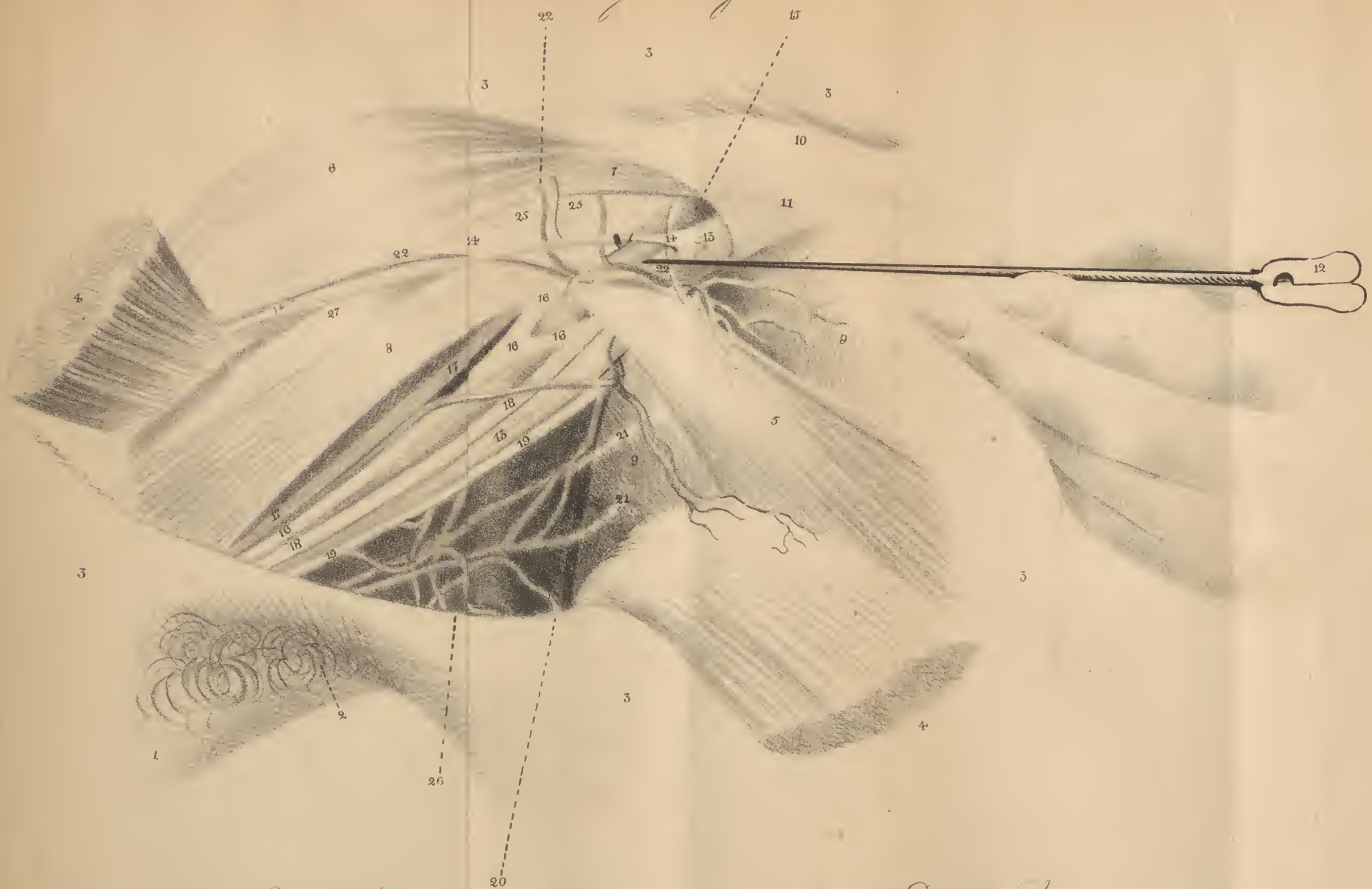
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*Supra-Clavicular
Region*



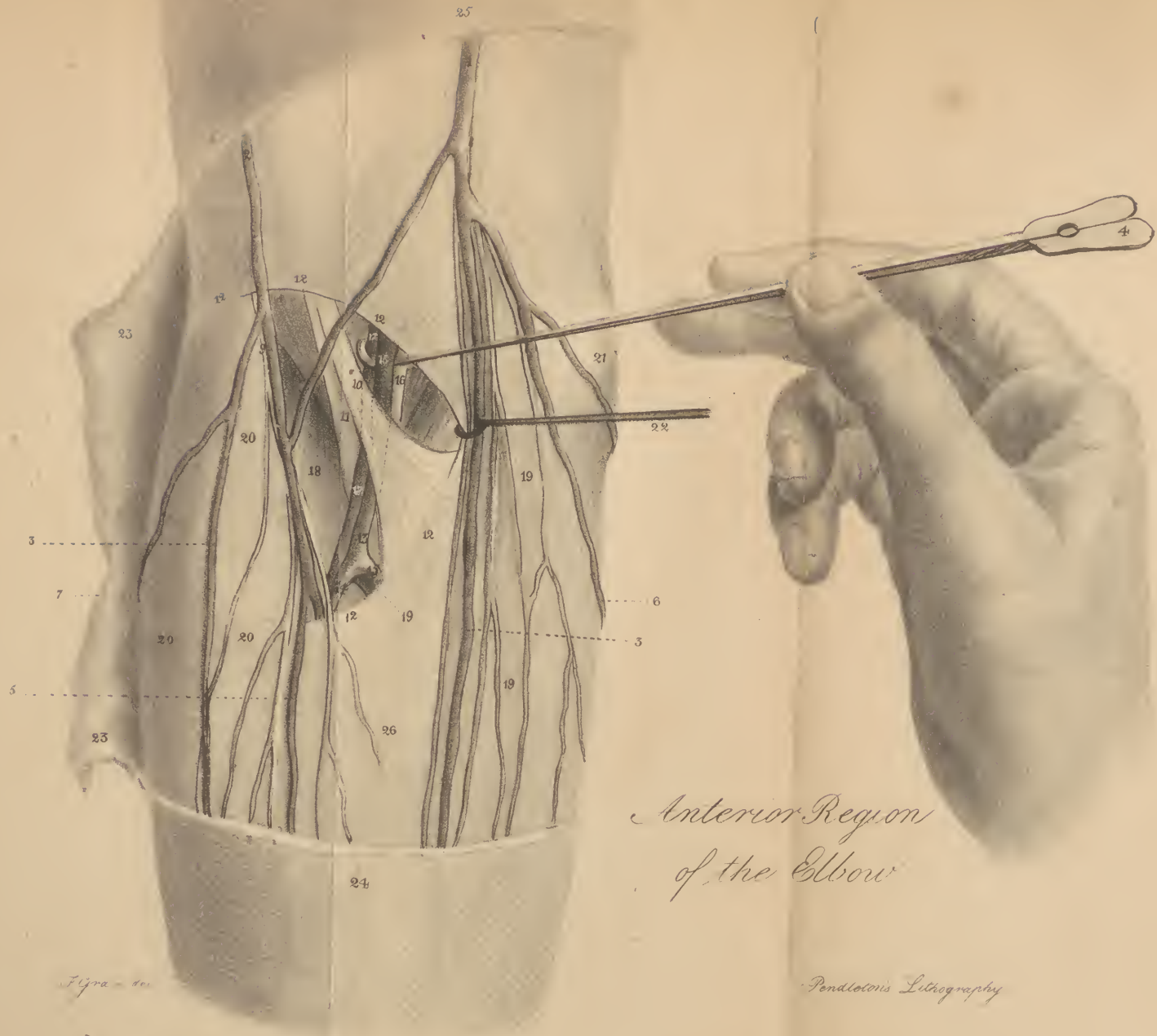


Axillary Region



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*Anterior Region
of the Elbow*

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