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Z O O N O M I A;
OR,
The Laws of Organic Life.

PART SECOND.

By ERASMUS DARWIN, M. D.

A NEW EDITION ;

WITH

An Introductory Address,

AND

A SHORT APPENDIX,

By CHARLES CALDWELL, M. D.
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MEMBER OF THE AMERICAN PHILOSOPHICAL SOCIETY,
&c. &c.

V O L. II.

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1797.





ZOONOMIA;

OR,

The Laws of Organic Life.

PART II.

CONTAINING

A CATALOGUE OF DISEASES

DISTRIBUTED INTO

NATURAL CLASSES ACCORDING TO THEIR
PROXIMATE CAUSES,

WITH THEIR

SUBSEQUENT ORDERS, GENERA, AND SPECIES,

AND WITH

THEIR METHODS OF CURE.

Hæc, ut potero, explicabo; nec tamen, quasi Pythius Apollo, certa ut sint et fixa, quæ dixero; sed ut Homunculus unus e multis probabiliora conjecturâ sequens.

Cic. Tusc. Disp. l. i. 9.

I
Darwin
V. 2

Z O O N O M I A.

P A R T II.

C L A S S III.

DISEASES OF VOLITION.

ORDO II.

Decreased Volition.

GENUS I.

With decreased Actions of the Muscles.

OUR muscles become fatigued by long contraction, and cease for a time to be excitable by the will ; owing to exhaustion of the sensorial power, which resides in them. After a short interval of relaxation the muscle regains its power of voluntary contraction ; which is probably occasioned by a new supply of the spirit of animation. In weaker people these contractions cease sooner, and therefore recur more frequently, and are attended with shorter intervals of relaxation, as exemplified in the quickness of the pulse in fevers with debility, and in the tremors of the hands of aged or feeble people.

After a common degree of exhaustion of the sensorial power in a muscle, it becomes again gradually restored by the rest of the muscle ; and even accumulated in

those muscles, which are most frequently used; as in those which constitute the capillaries of the skin after having been rendered torpid by cold. But in those muscles, which are generally obedient to volition, as those of locomotion, though their usual quantity of sensorial power is restored by their quiescence, or in sleep (for sleep affects these parts of the system only), yet but little accumulation of it succeeds. And this want of accumulation of the sensorial power in these muscles, which are chiefly subservient to volition, explains to us one cause of their greater tendency to paralytic affection.

It must be observed, that those parts of the system, which have been for a time quiescent from want of stimulus, as the vessels of the skin, when exposed to cold, acquire an accumulation of sensorial power during their inactivity; but this does not happen at all, or in much less quantity, from their quiescence after great expenditure of sensorial power by a previous excessive stimulus, as after intoxication. In this case the muscles or organs of sense gradually acquire their natural quantity of sensorial power; as after sleep; but not an accumulation or superabundance of it. And by frequent repetitions of exhaustion by great stimulus, these vessels cease to acquire their whole natural quantity of sensorial power; as in the scirrhus stomach, and scirrhus liver, occasioned by the great and frequent stimulus of vinous spirit; which may properly be termed irritative paralysis of those parts of the system.

In the same manner in common palsies the inaction of the paralytic muscles seems not to be owing to defect of the stimulus of the will, but to exhaustion of sensorial power. Whence it frequently follows great exertion, as in Sect. XXXIV. 1. 7. Thus some parts of the system may cease to obey the will, as in common paralysis; others may cease to be obedient to sensation, as in the impotency of age; others to irritation, as in schirrous viscera; and others to association, as in impediment of speech; yet though all these may become inexcitable, or dead, in respect to that kind of stimulus, which has previously exhausted them, whether of volition, or sensation, or irritation, or association, they may still in many cases be excited by the others.

SPECIES.

1. *Lassitudo*. Fatigue or weariness after much voluntary exertion. From the too great expenditure of sensorial power the muscles are with difficulty brought again into voluntary contraction; and seem to require a greater quantity or energy of volition for this purpose. At the same time they still remain obedient to the stimulus of agreeable sensation, as appears in tired dancers finding a renovation of their aptitude to motion on the acquisition of an agreeable partner; or from a tired child riding on a gold-headed cane, as in Sect. XXXIV. 2. 6. These muscles are likewise still obedient to the sensorial power of association, because the motions, when thus excited, are performed

in their designed directions, and are not broken into variety of gesticulation, as in St. Vitus's dance.

A lassitude likewise frequently occurs with yawning at the beginning of ague-fits; where the production of sensorial power in the brain is less than its expenditure. For in this case the torpor may either originate in the brain, or the torpor of some distant parts of the system may by sympathy affect the brain, though in a less proportionate degree than the parts primarily affected.

2. *Vacillatio senilis.* Some elderly people acquire a see-saw motion of their bodies from one side to the other, as they sit, like the oscillation of a pendulum. By these motions the muscles, which preserve the perpendicularity of the body, are alternately quiescent, and exerted; and are thus less liable to fatigue or exhaustion. This therefore resembles the tremors of old people above mentioned, and not those spasmodic movements of the face or limbs, which are called tricks, described in Class IV. 3. 2. 2. which originate from excess of sensorial power, or from efforts to relieve disagreeable sensation, and are afterwards continued by habit.

3. *Tremor senilis.* Tremor of old age consists of a perpetual trembling of the hands, or of the head, or of other muscles, when they are exerted; and is erroneously called paralytic; and seems owing to the small quantity of animal power residing in the muscular fibres.

fibres. These tremors only exist when the affected muscles are excited into action, as in lifting a glass to the mouth, or in writing, or in keeping the body upright; and cease again, when no voluntary exertion is attempted, as in lying down. Hence these tremors evidently originate from the too quick exhaustion of the lessened quantity of the spirit of animation. So many people tremble from fear or anger, when too great a part of the sensorial power is exerted on the organs of sense, so as to deprive the muscles, which support the body erect, of their due quantity.

4. *Brachiorum paralyfis.* A numbness of the arms is a frequent symptom in hydrops thoracis, as explained in Class I. 2. 3. 14. and in Sect. XXIX. 5. 2.; it also accompanies the asthma dolorificum, Class III. 1. 1. 11. and is owing probably to the same cause in both. In the colica saturnina a paralyfis affects the wrists, as appears on the patient's extending his arm horizontally with the palm downwards, and is often attended with a tumor on the carpal or metacarpal bones. See Class IV. 2. 2. 10.

Mr. M——, a miner and well-sinker, about three years ago, lost the power of contracting both his thumbs; the balls or muscles of the thumbs are much emaciated, and remain paralytic. He ascribes his disease to immersing his hands too long in cold water in the execution of his business. He says his hands had frequently been much benumbed before, so that he could not without difficulty clench them; but that

they recovered their motion, as soon as they began to glow, after he had dried and covered them.

In this case there existed two injurious circumstances of different kinds; one the violent and continued action of the muscles, which destroys by exhausting the sensorial power; and the other, the application of cold, which destroys by defect of stimulus. The cold seems to have contributed to the paralysis by its long application, as well as the continued exertion; but as during the torpor occasioned by the exposure to cold, if the degree of it be not so great as to extinguish life, the sensorial power becomes accumulated; there is reason to believe, that the exposing a paralytic limb to the cold for a certain time, as by covering it with snow or iced water for a few minutes, and then covering it with warm flannel, and this frequently repeated, might, by accumulation of sensorial power, contribute to restore it to a state of voluntary excitability. As this accumulation of sensorial power, and consequent glow, seems, in the present case, several times to have contributed to restore the numbness or inability of those muscles, which at length became paralytic. See Class I. 2. 3. 21.

M. M. Ether externally. Friction. Saline warm bath. Electricity.

5. *Rauedo paralytica*. Paralytic hoarseness consists in the almost total loss of voice, which sometimes continues for months, or even years, and is occasioned by inability or paralysis of the recurrent nerves, which
serve

serve the muscles of vocality, by opening or closing the larynx. The voice generally returns suddenly, even so as to alarm the patient. A young lady, who had many months been affected with almost a total loss of voice, and had in vain tried variety of advice, recovered her voice in an instant, on some alarm as she was dancing at an assembly. Was this owing to a greater exertion of volition than usual? like the dumb young man, the son of Cræsus, who is related to have cried out, when he saw his father's life endangered by the sword of his enemy, and to have continued to speak ever afterwards. Two young ladies in this complaint seemed to be cured by electric shocks passed through the larynx every day for a fortnight. See *Raucedo catarrhalis*, Class II. 1. 3. 5.

M. M. An emetic, Electric shocks. Mustard-feed, a large spoonful swallowed whole, or a little bruised, every morning. Valerian. Burnt sponge. Blisters on each side of the larynx. Sea-bathing. A gargle of decoction of feneca. Friction. Frequent endeavours to shout and sing.

6. *Vesicæ urinariæ paralysis*. Paralysis of the bladder is frequently a symptom in irritable fever; in this case the patient makes no water for a day or two; and the tumor of the bladder distended with urine may be seen by the shape of the abdomen, as if girt by a cord below the navel, or distinguished by the hand. Many patients in this situation make no complaint, and suffer great injury by the inattention of

their attendants; the water must be drawn off once or twice a day by means of a catheter, and the region of the bladder gently pressed by the hand, whilst the patient be kept in a sitting or erect posture.

M. M. Bark. Wine. Opium, a quarter of a grain every six hours. Balsam of copaiva or of Peru. Tincture of cantharides 20 drops twice a day, or repeated small blisters.

7. *Recti paralysis.* Palsy of the rectum. The rectum intestinum, like the urinary bladder in the preceding article, possesses voluntary power of motion; though these volitions are at times uncontrollable by the will, when the acrimony of the contained feces, or their bulk, stimulate it to a greater degree. Hence it happens, that this part is liable to lose its voluntary power by paralysis, but is still liable to be stimulated into action by the contained feces. This frequently occurs in fevers, and is a bad sign as a symptom of general debility; and it is the sensibility of the muscular fibres of this and of the urinary bladder remaining, after the voluntariness has ceased, which occasions these two reservoirs so soon to regain, as the fever ceases, their obedience to volition; because the paralysis is thus shewn to be less complete in those cases than in common hemiplegia; as in the latter the sense of touch, though perhaps not the sense of pain, is generally destroyed in the paralytic limb.

M. M. A sponge introduced within the sphincter ani to prevent the constant discharge, which should
have

have a string put through it, by which it may be retracted.

8. *Paresis voluntaria*. Indolence; or inaptitude to voluntary action. This debility of the exertion of voluntary efforts prevents the accomplishment of all great events in life. It often originates from a mistaken education, in which pleasure or flattery is made the immediate motive of action, and not future advantage; or what is termed duty. This observation is of great value to those, who attend to the education of their own children. I have seen one or two young married ladies of fortune, who perpetually became uneasy, and believed themselves ill, a week after their arrival in the country, and continued so uniformly during their stay; yet on their return to London or Bath immediately lost all their complaints, and this repeatedly; which I was led to ascribe to their being in their infancy surrounded with menial attendants, who had flattered them into the exertions they then used. And that in their riper years, they became torpid for want of this stimulus, and could not amuse themselves by any voluntary employment; but required ever after, either to be amused by other people, or to be flattered into activity. This I suppose, in the other sex, to have supplied one source of ennui and suicide.

9. *Catalepsis* is sometimes used for fixed spasmodic contractions or tetanus, as described in Sect. XXXIV, 1. 5. and in Class III. 1. 1. 13. but is properly
 simply

simply an inaptitude to muscular motion, the limbs remaining in any attitude in which they are placed. One patient, whom I saw in this situation, had taken much mercury, and appeared universally torpid. He sat in a chair in any posture he was put, and held a glass to his mouth for many minutes without attempting to drink, or withdrawing his hand. He never spoke, and it was at first necessary to compel him to drink broth; he recovered in a few weeks without relapse.

10. *Hemiplegia*. Palsy of one side consists in the total disobedience of the affected muscles to the power of volition. As the voluntary motions are not perpetually exerted, there is little sensorial power accumulated during their quiescence, whence they are less liable to recover from torpor, and are thus more frequently left paralytic, or disobedient to the power of volition, though they are sometimes still alive to painful sensation, as to the prick of a pin, and to heat; also to irritation, as in stretching and yawning; or to electric shocks. Where the paralysis is complete the patient seems gradually to learn to use his limbs over again by repeated efforts, as in infancy; and, as time is required for this purpose, it becomes difficult to know, whether the cure is owing to the effect of medicines, or to the repeated efforts of the voluntary power.

The dispute, whether the nerves decussate or cross each other before they leave the cavities of the skull

or spine, seems to be decided in the affirmative by comparative anatomy; as the optic nerves of some fish have been shewn evidently to cross each other; as seen by Haller, *Elem. Physiol.* t. v. p. 349. Hence the application of blisters, or of ether, or of warm fomentations, should be on the side of the head opposite to that of the affected muscles. This subject should nevertheless be nicely determined, before any one should trepan for the hydrocephalus internus, when the disease is shewn to exist only on one side of the brain, by a squinting affecting but one eye; as proposed in Class I. 2. 5. 4. Dr. Sommering has shewn, that a true decussation of the optic nerves in the human subject actually exists, *Elem. of Physiology* by Blumenbach, translated by C. Caldwell, Philadelphia. This further appears probable from the oblique direction and insertion of each optic nerve, into the side of the eye next to the nose, in a direct line from the opposite side of the brain.

The vomiting, which generally attends the attack of hemiplegia, is mentioned in Sect. XX. 8. and is similar to that attending vertigo in sea-sickness, and at the commencement of some fevers. Black stools sometimes attend the commencement of hemiplegia, which is probably an effusion of blood from the biliary duct, where the liver is previously affected; or some blood may be derived to the intestines by its escaping from the vena cava into the receptacle of chyle during the distress of the paralytic attack; and may be conveyed from thence into the intestines

by

by the retrograde motions of the lacteals; as probably sometimes happens in diabætes. See Sect. XXVII. 2. Palsy of one side of the face is mentioned in Class II. 1. 4. 6. Paralysis of the lacteals, of the liver, and of the veins, which are described in Sect. XXVIII. XXX. and XXVII. do not belong to this class, as they are not diseases of voluntary motions.

M. M. The electric sparks and shocks, if used early in the disease, are frequently of service. A purge of aloes, or calomel. A vomit. Blister. Saline draughts. Then the bark. Mercurial ointment or sublimate, where the liver is evidently diseased; or where the gutta rosea has previously existed. Sudden alarm. Frequent voluntary efforts. Externally ether. Volatile alkali. Fomentation on the head. Friction. When children, who have suffered an hemiplegia, begin to use the affected arm, the other hand should be tied up for half an hour three or four times a day; which obliges them at their play to use more frequent voluntary efforts with the diseased limb, and thus sooner to restore the disordered associations of motion.

Dr. J. Alderson has lately much recommended the leaves of *Rhus toxicodendron* (sumach), from one gr. to iv. of the dried powder to be taken three or four times a day. Essay on Rus Toxic. Johnson, London, 1793. But it is difficult to know what medicine is of service, as the movements of the muscles must be learned, as in infancy, by frequent efforts.

II. *Paraplegia*. A palsy of the lower half of the body divided horizontally. Animals may be conceived to have double bodies, one half in general resembling so exactly the other, and being supplied with separate seats of nerves; this gives rise to hemiplegia, or palsy of one half of the body divided vertically; but the paraplegia, or palsy of the lower parts of the system, depends on an injury of the spinal marrow, or that part of the brain which is contained in the vertebræ of the back; by which all the nerves situated below the injured part are deprived of their nutriment, or precluded from doing their proper offices; and the muscles, to which they are derived, are in consequence disobedient to the power of volition.

This sometimes occurs from an external injury, as a fall from an eminence; of which I saw a deplorable instance, where the bladder and rectum, as well as the lower limbs, were deprived of so much of their powers of motion, as depended on volition or sensation; but I suppose not of that part of it, which depends on irritation. In the same manner as the voluntary muscles in hemiplegia are sometimes brought into action by irritation, as in stretching or penduculation, described in Sect. VII. 1. 3.

But the most frequent cause of paraplegia is from a protuberance of one of the spinal vertebræ; which is owing to the innutrition or softness of bones, described in Class I. 2. 2. 17. The cure of this deplorable disease is frequently effected by the stimulus
of

of an issue placed on each side of the prominent spine, as first published by Mr. Pott. The other means recommended in softness of bones should also be attended to; both in respect to the internal medicines, and to the mechanical methods of supporting, or extending the spine; which last, however, in this case requires particular caution.

12. *Somnus*. In sleep all voluntary power is suspended, see Sect. XVIII. An unusual quantity of sleep is often produced by weakness. In this case small doses of opium, wine, and bark, may be given with advantage. For the periods of sleep, see Class IV. 2. 4. 1.

The subsequent ingenious observations on the frequency of the pulse, which sometimes occurs in sleep, are copied from a letter of Dr. Currie of Liverpool to the author.

“ Though rest in general perhaps renders the healthy pulse slower, yet under certain circumstances the contrary is the truth. A full meal without wine or other strong liquor does not increase the frequency of my pulse, while I sit upright, and have my attention engaged. But if I take a recumbent posture after eating, my pulse becomes more frequent, especially if my mind be vacant, and I become drowsy; and, if I slumber, this increased frequency is more considerable with heat and flushing.

“ This I apprehend to be a general truth. The observation may be frequently made upon children; and

and the restless and feverish nights experienced by many people after a full supper are, I believe, owing to this cause. The supper occasions no inconvenience, whilst the person is upright and awake; but, when he lies down and begins to sleep, especially if he does not perspire, the symptoms above mentioned occur. Which may be thus explained in part from your principles. When the power of volition is abolished, the other sensorial actions are increased. In ordinary sleep this does not occasion increased frequency of the pulse; but where sleep takes place during the process of digestion, the digestion itself goes on with increased rapidity. Heat is excited in the system faster than it is expended; and operating on the sensitive actions, it carries them beyond the limitation of pleasure, producing, as is common in such cases, increased frequency of pulse.

“ It is to be observed, that in speaking of the heat generated under these circumstances, I do not allude to any chemical evolution of heat from the food in the process of digestion. I doubt if this takes place to any considerable degree, for I do not observe that the parts incumbent on the stomach are increased in heat during the most hurried digestion. It is on some parts of the surface, but more particularly on the extremities of the body, that the increased heat excited by digestion appears, and the heat thus produced arises, as it should seem, from the sympathy between the stomach and the vessels of the skin. The parts most affected are the palms of the hands and the soles of the feet.

Even

Even there the thermometer seldom rises above 97 or 98 degrees, a temperature not higher than that of the trunk of the body; but three or four degrees higher than the common temperature of these parts, and therefore producing an uneasy sensation of heat, a sensation increased by the great sensibility of the parts affected.

“That the increased heat excited by digestion in sleep is the cause of the accompanying fever, seems to be confirmed by observing, that if an increased expenditure of heat accompanies the increased generation of it (as when perspiration on the extremities or surface attends this kind of sleep) the frequent pulse and flushed countenance do not occur, as I know by experiment. If, during the feverish sleep already mentioned, I am awakened, and my attention engaged powerfully, my pulse becomes almost immediately slower, and the fever gradually subsides.”

From these observations of Dr. Currie it appears, that, while in common sleep the actions of the heart, arteries, and capillaries, are strengthened by the accumulation of sensorial power during the suspension of voluntary action, and the pulse in consequence becomes fuller and slower; in the feverish sleep above described the actions of the heart, arteries, and capillaries, are quickened as well as strengthened by their consent with the increased actions of the stomach, as well as by the stimulus of the new chyle introduced into the circulation. For the stomach, and all other parts of the system, being more sensible and more

irritable during sleep, Sect. XVIII. 15. and probably more ready to act from association, are now exerted with greater velocity as well as strength, constituting a temporary fever of the sensitive irritated kind, resembling the fever excited by wine in the beginning of intoxication; or in some people by a full meal in their waking hours. Sect XXXV. 1.

On waking, this increased sensibility and irritability of the system ceases by the renewed exertions of volition; in the same manner as more violent exertions of volition destroy greater pains; and the pulse in consequence subsides along with the increase of heat; if more violent efforts of volition are exerted, the system becomes still less affected by sensation or irritation. Hence the fever and vertigo of intoxication are lessened by intense thinking, Sect. XXI. 8; and insane people are known to bear the pain of cold and hunger better than others, Sect. XXXIV. 2. 5; and lastly, if greater voluntary efforts exist, as in violent anger or violent exercise, the whole system is thrown into more energetic action, and a voluntary fever is induced, as appears by the red skin, quickened pulse, and increase of heat; whence dropsies and fevers with debility are not unfrequently removed by insanity.

Hence the exertion of the voluntary power in its natural degree diminishes the increased sensibility, and irritability, and probably the increased associability, which occurs during sleep; and thus reduces the frequency of the pulse in the feverish sleep after a full meal. In its more powerful state of exertion, it dimi-

nishes or destroys sensations and irritations, which are stronger than natural, as in intoxication, or which precede convulsions, or insanity. In its still more powerful degree, the superabundance of this sensorial power actuates and invigorates the whole moving system, giving strength and frequency to the pulse, and an universal glow both of colour and of heat, as in violent anger, or outrageous insanities.

If, in the feverish sleep above described, the skin becomes cooled by the evaporation of much perspirable matter, or by the application of cooler air, or thinner clothes, the actions of the cutaneous capillaries are lessened by defect of the stimulus of heat, which counteracts the increase of sensibility during sleep, and the pulsations of the heart and arteries become slower from the lessened stimulus of the particles of blood thus cooled in the cutaneous and pulmonary vessels. Hence the admission of cold air, or ablution with sub-tepid or with cold water, in fevers with hot skin, whether they be attended with arterial strength, or arterial debility, renders the pulse slower; in the former case by diminishing the stimulus of the blood, and in the latter by lessening the expenditure of sensorial power. See Suppl. I. 8. and 15.

13. *Incubus.* The night-mare is an imperfect sleep, where the desire of locomotion is vehement, but the muscles do not obey the will; it is attended with great uneasiness, a sense of suffocation, and frequently with fear. It is caused by violent fatigue, or drunkenness,

or indigestible food, or lying on the back, or perhaps from many other kinds of uneasiness in our sleep, which may originate either from the body or mind.

Now as the action of respiration is partly voluntary, this complaint may be owing to the irritability of the system being too small to carry on the circulation of the blood through the lungs during sleep, when the voluntary power is suspended. Whence the blood may accumulate in them, and a painful oppression supervene; as in some hæmorrhages of the lungs, which occur during sleep; and in patients much debilitated by fevers. See *Somnus interruptus*, Class I. 2. 1. 3. and I. 2. 1. 9.

Great fatigue with a full supper and much wine, I have been well informed by one patient, always produced this disease in himself to a great degree. Now the general irritability of the system is much decreased by fatigue, as it exhausts the sensorial power; and secondly, too much wine and stimulating food will again diminish the irritability of some parts of the system, by employing a part of the sensorial power, which is already too small, in digesting a great quantity of aliment; and in increasing the motions of the organs of sense in consequence of some degree of intoxication, whence difficulty of breathing may occur from the inirritability of the lungs, as in Class I. 2. 1. 3.

M. M. To sleep on a hard bed with the head raised. Moderate supper. The bark. By sleeping on a harder bed the patient will turn himself more frequently,

and not be liable to sleep too profoundly, or lie too long in one posture. To be awakened frequently by an alarm clock.

14. *Lethargus*. The lethargy is a slighter apoplexy. It is supposed to originate from universal pressure on the brain, and is said to be produced by compressing the spinal marrow, where there is a deficiency of the bone in the spina bifida. See Sect. XVIII. 20. Whereas in the hydrocephalus there is only a partial pressure of the brain; and probably in nervous fevers with stupor the pressure on the brain may affect only the nerves of the senses, which lie within the skull, and not those nerves of the medulla oblongata, which principally contribute to move the heart and arteries; whence in the lethargic or apoplectic stupor the pulse is slow as in sleep, whereas in nervous fever the pulse is very quick and feeble, and generally so in hydrocephalus.

In cases of obstructed kidneys, whether owing to the tubuli uriniferi being totally obstructed by calculous matter, or by their paralysis, a kind of drowsiness or lethargy comes on about the eighth or ninth day, and the patient gradually sinks. See Class I. 1.

3. 9.

15. *Syncope epileptica*, is a temporary apoplexy, the pulse continuing in its natural state, and the voluntary power suspended. This terminates the paroxysms of epilepsy.

When

When the animal power is much exhausted by the preceding convulsions, so that the motions from sensation as well as those from volition are suspended; in a quarter or half an hour the sensorial power becomes restored, and if no pain, or irritation producing pain, recurs, the fit of epilepsy ceases; if the pain recurs, or the irritation, which used to produce it, a new fit of convulsion takes place, and is succeeded again by a syncope. See Epilepsy, Class III. 1. 1. 7.

16. *Apoplexia.* Apoplexy may be termed an universal palsy, or a permanent sleep. In which, where the pulse is weak, copious bleeding must be injurious; as is well observed by Dr. Heberden, Transf. of the College.

Mr. —, about 70 years of age, had an apoplectic seizure. His pulse was strong and full. One of the temporal arteries was opened, and about ten ounces of blood suddenly taken from it. He seemed to receive no benefit from this operation; but gradually sunk, and lived but a day or two.

If apoplexy arises from the pressure of blood extravasated on the brain, one moderate venesection may be of service to prevent the further effusion of blood; but copious venesection must be injurious by weakening the patient; since the effused blood must have time, as in common vibices or bruises, to undergo a chemic-animal process, so to change its nature as to fit it for absorption; which may take two or three weeks, which time a patient weakened by repeated venesection or arteriotomy may not survive.

Mrs. —, about 40 years old, had an apoplectic seizure after great exertion from fear; she had lain about 24 hours without speech, or having swallowed any liquid. She was then forcibly raised in bed, and a spoonful of solution of aloes in wine put into her mouth, and the end of the spoon withdrawn, that she might more easily swallow the liquid.—This was done every hour, with broth, and wine and water intervening, till evacuations were procured; which with other means had good effect, and she recovered, except that a considerable degree of hemiplegia remained, and some imperfection of her speech.

Many people, who have taken so much vinous spirit as to acquire the temporary apoplexy of intoxication, and are not improperly said to be dead-drunk, have died after copious venesection, I suppose in consequence of it. I once saw at a public meeting two gentlemen in the drunken apoplexy; they were totally insensible with low pulse, on this account they were directed not to lose blood, but to be laid on a bed with their heads high, and to be turned every half hour; as soon as they could swallow, warm tea was given them, which evacuated their stomachs, and they gradually recovered, as people do from less degrees of intoxication.

M. M. Cupping on the occiput. Venesection once in moderate quantity. Warm fomentations long continued and frequently repeated on the shaved head. Solution of aloes. Clysters with solution of aloe and oil of amber. A blister on the spine. An emetic.
Afterwards

Afterwards the bark, and small does of chalybeates. Small electric shocks through the head. Errhines. If small doses of opium?

17. *Mors a frigore.* Death from cold. The unfortunate travellers, who almost every winter perish in the snow, are much exhausted by their efforts to proceed on their journey, as well as benumbed by cold. And as much greater exercise can be borne without fatigue in cold weather than in warm; because the excessive motions of the cutaneous vessels are thus prevented, and the consequent waste of sensorial power; it may be inferred, that the fatigued traveller becomes paralytic from violent exertion as well as by the application of cold.

Great degrees of cold affect the motions of those vessels most, which have been generally excited into action by irritation; for when the feet are much benumbed by cold, and painful, and at the same time almost insensible to the touch of external objects, the voluntary muscles retain their motions, and we continue to walk on; the same happens to the fingers of children in throwing snow-balls, the voluntary motions of the muscles continue, though those of the cutaneous vessels are benumbed into inactivity.

Mr. Thompson, an elderly gentleman of Shrewsbury, was seized with hemiplegia in the cold bath; which I suppose might be owing to some great energy of exertion, as much as to the coldness of the water. As in the instance given of Mr. Nairn, who, by the

exertion to save his relation, perished himself. See Sect. XXXIV. 1. 7.

Whence I conclude, that though heat is a fluid necessary to muscular motion, both perhaps by its stimulus, and by its keeping the minute component parts of the ultimate fibrils of the muscles or organs of sense at a proper distance from each other; yet that paralysis, properly so called, is the consequence of exhaustion of sensorial power by exertion. And that the accumulations of it during the torpor of the cutaneous vessels by exposure to cold, or of some internal viscus in the cold fits of agues, are frequently instrumental in recovering the use of paralytic limbs, or of the motions of other paralytic parts of the system, See Spec. 4. of this genus.

Animal bodies resist the power of cold probably by their exertions in consequence of the pain of cold, see Botan. Gard. V. 1. additional note xii. But if these increased exertions be too violent, so as to exhaust the sensorial power in producing unnecessary motions, the animal will probably sooner perish. Thus a moderate quantity of wine or spirit repeated at proper intervals of time might be of service to those, who are long exposed to excessive cold, both by increasing the action of the capillary vessels, and thus producing heat, and perhaps by increasing in some degree the secretion of sensorial power in the brain. But the contrary must happen when taken immoderately, and not at due intervals. A well attested history was once related to me of two men, who set
out

out on foot to travel in the snow, one of whom drank two or three glasses of brandy before they began their journey, the other contented himself with his usual diet and potation; the former of whom perished in spite of any assistance his companion could afford him; and the other performed his journey with safety. In this case the sensorial power was exhausted by the unnecessary motions of incipient intoxication by the stimulus of the brandy, as well as by the exertions of walking; which so weakened the dram-drinker, that the cold sooner destroyed him; that is, he had not power to produce sufficient muscular or arterial action, and in consequence sufficient heat, to supply the great expenditure of it. Hence the capillaries of the skin first cease to act, and become pale and empty; next those which are immediately associated with them, as the extremities of the pulmonary artery, as happens on going into the cold bath. By the continued inaction of these parts of the vascular system the blood becomes accumulated in the internal arteries, and the brain is supposed to be affected by its compression; because these patients are said to sleep, or to become apoplectic, before they die. I overtook a fishman asleep on his panniers on a very cold frosty night, but on waking him he did not appear to be in any degree of stupor. See Class I. 2.

2. I.

When travellers are benighted in deep snow, they might frequently be saved by covering themselves in it, except a small aperture for air; in which situation the lives of hares, sheep, and other animals, are

so often preserved. The snow, both in respect to its component parts, and to the air contained in its pores, is a bad conductor of heat, and will therefore well keep out the external cold; and as the water, when part of it dissolves, is attracted into the pores of the remainder of it, the situation of an animal beneath it is perfectly dry; and, if he is in contact with the earth, he is in a degree of heat between 48, the medium heat of the earth, and 32, the freezing point; that is, in 40 degrees of heat, in which a man thus covered will be as warm as in bed. See *Botan. Garden*, V. II. notes on *Anemone*, *Barometz*, and *Muschus*. If these facts were more generally understood, it might annually save the lives of many.

After any part of the vascular system of the body has been long exposed to cold, the sensorial power is so much accumulated in it, that on coming into a warm room the pain of hotach is produced, and inflammation, and consequent mortification, owing to the great exertion of those vessels, when again exposed to a moderate degree of warmth. See *Sect. XII. 5.* Whence the propriety of applying but very low degrees of heat to limbs benumbed with cold at first, as of snow in its state of dissolving, which is at 32 degrees of heat, or of very cold water. A French writer has observed, that if frozen apples be thawed gradually by covering them with thawing snow, or immersing them in very cold water, that they do not lose their taste; if this fact was well ascertained, it might teach us how to preserve other ripe fruits in ice-houses for winter consumption.

ORDO II.

Decreased Volition.

GENUS II.

With decreased Actions of the Organs of Sense.

SPECIES.

1. *Recollectionis jactura.* Loss of recollection. This is the defect of memory in old people, who forget the actions of yesterday, being incapable of voluntary recollection, and yet remember those of their youth, which by frequent repetition are introduced by association or suggestion. This is properly the paralysis of the mind; the organs of sense do not obey the voluntary power; that is, our ideas cannot be recollected, or acted over again by the will.

After an apoplectic attack the patients, on beginning to recover, find themselves most at a loss in recollecting proper names of persons or places; as those words have not been so frequently associated with the ideas they stand for, as the common words of a language. Mr. ———, a man of strong mind, of a short necked family, many of whom had suffered by apoplexy, after an apoplectic fit on his recovering the use of speech, after repeated trials to remember the name of a person or place, applauded himself, when he succeeded, with such a childish smile on the partial return of his sagacity, as very much affected me.—

Not

Not long, alas! to return; for another attack in a few weeks destroyed the whole.

I saw a child after the small-pox, which was left in this situation; it was lively, active, and even vigorous; but shewed that kind of surprize, which novelty excites, at every object it viewed; and that as often as it viewed it. I never heard the termination of the case.

2. *Stultitia voluntaria.* Voluntary folly. The absence of voluntary power and consequent incapacity to compare the ideas of present and future good. Brute animals may be said to be in this situation, as they are in general excited into action only by their present painful or pleasurable sensations. Hence though they are liable to surprize, when their passing trains of ideas are disordered by violent stimuli; yet are they not affected with wonder or astonishment at the novelty of objects; as they possess but in a very inferior degree, that voluntary power of comparing the present ideas with those previously acquired, which distinguishes mankind; and is termed analogical reasoning, when deliberately exerted; and intuitive analogy, when used without our attention to it, and which always preserves our hourly trains of ideas consistent with truth and nature. See Sect. XVII. 3. 7.

3. *Credulitas.* Credulity. Life is short, opportunities of knowledge rare; our senses are fallacious, our reasonings uncertain, man therefore struggles with

with perpetual error from the cradle to the coffin. He is necessitated to correct experiment by analogy, and analogy by experiment; and not always to rest satisfied in the belief of facts even with this two-fold testimony, till future opportunities, or the observations of others, concur in their support.

Ignorance and credulity have ever been companions, and have misled and enslaved mankind; philosophy has in all ages endeavoured to oppose their progress, and to loosen the shackles they had imposed; philosophers have on this account been called unbelievers: unbelievers of what? of the fictions of fancy, of witchcraft, hobgoblins, apparitions, vampires, fairies; of the influence of stars on human actions, miracles wrought by the bones of saints, the flights of ominous birds, the predictions from the bowels of dying animals, expounders of dreams, fortune-tellers, conjurers, modern prophets, necromancy, cheiromancy, animal magnetism, with endless variety of folly? These they have disbelieved and despised, but have ever bowed their hoary heads to truth and Nature.

Mankind may be divided in respect to the facility of their belief or conviction into two classes; those, who are ready to assent to single facts from the evidence of their senses, or from the serious assertions of others; and those, who require analogy to corroborate or authenticate them.

Our first knowledge is acquired by our senses; but these are liable to deceive us, and we learn to detect these deceptions by comparing the ideas presented to us by one sense with those presented by another.

Thus

Thus when we first view a cylinder, it appears to the eye as a flat surface with different shades on it, till we correct this idea by the sense of touch, and find its surface to be circular; that is, having some parts gradually receding further from the eye than others. So when a child, or a cat, or a bird, first sees its own image in a looking-glass, it believes that another animal exists before it, and detects this fallacy by going behind the glass to examine, if another tangible animal really exists there.

Another exuberant source of error consists in the false notions, which we receive in our early years from the design or ignorance of our instructors, which affect all our future reasoning by their perpetual instructions; as those habits of muscular actions of the face or limbs, which are called tricks, when contracted in infancy continue to the end of our lives.

A third great source of error is the vivacity of our ideas of imagination, which perpetually intrude themselves by various associations, and compose the farrago of our dreams; in which, by the suspension of volition, we are precluded from comparing the ideas of one sense with those of another, or the incongruity of their successions with the usual course of nature, and thus to detect their fallacy. Which we do in our waking hours by a perpetual voluntary exertion, a process of the mind above mentioned, which we have termed intuitive analogy. Sect. XVII. 3. 7.

This analogy presupposes an acquired knowledge of things, hence children and ignorant people are the most credulous, as not possessing much knowledge of
the

the usual course of nature; and secondly, those are most credulous, whose faculty of comparing ideas, or the voluntary exertion of it, is slow or imperfect. Thus if the power of the magnetic needle of turning towards the north, or the shock given by touching both sides of an electrized coated jar, was related for the first time to a philosopher, and to an ignorant person; the former would be less ready to believe them, than the latter; as he would find nothing similar in nature to compare them to, he would again and again repeat the experiment, before he would give it his entire credence; till by these repetitions it would cease to be a single fact, and would therefore gain the evidence of analogy. But the latter, as having less knowledge of nature, and less facility of voluntary exertion, would more readily believe the assertions of others, or a single fact, as presented to his own observation. Of this kind are the bulk of mankind; they continue throughout their lives in a state of childhood, and have thus been the dupes of priests and politicians in all countries and in all ages of the world.

In regard to religious matters, there is an intellectual cowardice instilled into the minds of the people from their infancy, which prevents their inquiry: credulity is made an indispensable virtue; to inquire or exert their reason in religious matters is denounced as sinful; and in the catholic church is punished with more severe penances than moral crimes. But in respect to our belief of the supposed medical facts, which
are

are published by variety of authors; many of whom are ignorant, and therefore credulous; the golden rule of David Hume may be applied with great advantage. "When two miraculous assertions oppose each other, believe the less miraculous." Thus if a person is said to have received the small-pox a second time, and to have gone through all the stages of it, one may thus reason: twenty thousand people have been exposed to the variolous contagion a second time without receiving the variolous fever, to every one who has been said to have thus received it; it appears therefore less miraculous, that the asserter of this supposed fact has been deceived, or wishes to deceive, than that it has so happened contrary to the long experienced order of nature.

M. M. The method of cure is to increase our knowledge of the laws of nature, and our habit of comparing whatever ideas are presented to us with those known laws, and thus to counteract the fallacies of our senses, to emancipate ourselves from the false impressions which we have imbibed in our infancy, and to set the faculty of reason above that of imagination.

THE ORDERS AND GENERA OF THE FOURTH CLASS
OF DISEASES.

CLASS IV.

DISEASES OF ASSOCIATION.

ORDO I.

Increased Associate Motions.

GENERA.

1. Catenated with irritative motions.
2. Catenated with sensitive motions.
3. Catenated with voluntary motions.
4. Catenated with external influences.

ORDO II.

Decreased Associate Motions.

GENERA.

1. Catenated with irritative motions.
2. Catenated with sensitive motions.
3. Catenated with voluntary motions.
4. Catenated with external influences.

ORDO III.

Retrograde Associate Motions.

GENERA.

1. Catenated with irritative motions.
2. Catenated with sensitive motions.
3. Catenated with voluntary motions.
4. Catenated with external influences.

THE ORDERS, GENERA, AND SPECIES, OF THE FOURTH
CLASS OF DISEASES.

C L A S S I V.

DISEASES OF ASSOCIATION.

ORDO I.

Increased Associate Motions.

GENUS I.

Catenated with Irritative Motions.

SPECIES.

1. *Rubor vultus pransorum.* Flushing of the face after dinner.
2. *Sudor stragulis immerforum.* Sweat from covering the face in bed.
3. *Cessatio ægritudinis cute excitata.* Cure of sickness by stimulating the skin.
4. *Digestio aucta frigore cutaneo.* Digestion increased by coldness of the skin.
5. *Catarrhus a frigore cutaneo.* Catarrh from cold skin.
6. *Absorptio cellularis aucta vomitu.* Cellular absorption increased by vomiting.
7. *Synguitus nephriticus.* Nephritic hicough.
8. *Febris irritativa.* Irritative fever.

GENUS

GENUS II.

Catenated with Sensitive Motions.

SPECIES:

1. *Lacrymarum fluxus sym- patheticus.* Sympathetic tears.
2. *Sternutatio a lumine.* Sneezing from light.
3. *Dolor dentium a stridore.* Tooth-edge from grating sounds.
4. *Risus sardonicus.* Sardonic smile.
5. *Salivæ fluxus cibo viso.* Flux of saliva at sight of food.
6. *Tensio mamularum viso puerulo.* Tension of the nipples of lactescent women at sight of the child.
7. *Tensio penis in hydrophobia.* Tension of the penis in hydrophobia.
8. *Tenesmus calculosus.* Tenesmus from stone.
9. *Polypus narium ex ascaride.* Polypus of the nose from ascarides.
10. *Crampus surarum in diarrhœa.* Cramp from diarrhœa.
11. *Zona ignea nephritica.* Nephritic shingles.
12. *Eruptio variolarum.* Eruption of small-pox.
13. *Gutta rosea stomatica.* Stomatic rosy drop.
14. ————— *hepatica.* Hepatic rosy drop.
15. *Podagra.* Gout.
16. *Rheumatismus.* Rheumatism.
17. *Erysipelas.* Erysipelas.

18. *Testium tumor in gonorrhœa*. Swelled testes in gonorrhœa.
rhœa.
19. ————— *in parotidide.* ————— in mumps.

GENUS III.

Catenated with Voluntary Motions.

SPECIES.

- | | |
|--|------------------------------------|
| 1. <i>Deglutitio invita.</i> | Involuntary deglutition. |
| 2. <i>Nictitatio invita.</i> | ————— nictitation. |
| 3. <i>Risus invitus.</i> | ————— laughter. |
| 4. <i>Lusus digitorum invitus.</i> | ————— actions with the
fingers. |
| 5. <i>Unguium morsuncula
 invita.</i> | ————— biting the nails. |
| 6. <i>Vigilia invita.</i> | ————— watchfulness. |

GENUS IV.

Catenated with External Influences.

SPECIES.

- | | |
|--|------------------------------------|
| 1. <i>Vita ovi.</i> | Life of an egg. |
| 2. <i>Vita hiemi-dormientium.</i> | Life of winter-sleepers. |
| 3. <i>Pullulatio arborum.</i> | Budding of trees. |
| 4. <i>Orgasmatis venerei periodus.</i> | Periods of venereal desire. |
| 5. <i>Brachii concussio electrica.</i> | Electric shock through the
arm. |
| 6. <i>Oxygenatio sanguinis.</i> | Oxygenation of the blood. |
| 7. <i>Humectatio corporis.</i> | Humectation of the body. |

ORDO II.

Decreased Associate Motions.

GENUS I.

Catenated with Irritative Motions.

SPECIES.

1. *Cutis frigida pranforum.* Chillness after dinner.
2. *Pallor urinæ pranforum.* Pale urine after dinner.
3. ———— *a frigore* ———— from cold skin.
cutaneo.
4. *Pallor ex ægritudine.* Paleness from sickness.
5. *Dyspnæa a balneo frigido.* Shortness of breath from
cold bathing.
6. *Dyspepsia a pedibus frigidis.* Indigestion from cold feet.
7. *Tussis a pedibus frigidis.* Cough from cold feet.
8. ———— *hepatica.* Liver-cough.
9. ———— *arthritica.* Gout-cough.
10. *Vertigo rotatoria.* Vertigo rotatory.
11. ———— *visualis.* ———— visual.
12. ———— *ebriosa.* ———— inebriate.
13. ———— *febriculosa.* ———— feverish.
14. ———— *cerebrosa.* ———— from the brain.
15. *Murmur aurium vertiginosum.* Noise in the ears.
16. *Tactus, gustus, olfactus vertiginosi.* Vertiginous touch, taste,
smell.
17. *Pulsus mollis a vomitione.* Soft pulse in vomiting.

18. *Pulsus intermittens a* Intermittent pulse from the
ventriculo. stomach.
19. *Febris inirritativa.* Inirritative fever.

GENUS II.

Catenated with Sensitive Motions.

SPECIES.

1. *Torpor genæ a dolore* Coldness of the cheek from
dentis. tooth-ach.
2. *Stranguria a dolore ve-* Strangury from pain of the
sicæ. bladder.
3. ————— *convulsiva.* Convulsive strangury.
4. *Dolor termini ductûs* Pain of the end of the bile-
choledochi. duct.
5. *Dolor pharyngis ab aci-* Pain of the throat from
do gastrico. gastric acid.
6. *Pruritus narium a ver-* Itching of the nose from
mibus. worms.
7. *Cephalæa.* Head-ach.
8. *Hemicrania et otalgia.* Partial head-ach, and ear-
 ach.
9. *Dolor humeri in hepati-* Pain of shoulder in hepatitis.
dide.
10. *Torpor pedum variolâ* Cold feet in eruption of
erumpente. small-pox.
11. *Testium dolor nephriti-* Nephritic pain of testis.
cus.
12. *Dolor digiti minimi sym-* Pain of little finger from
patheticus. sympathy.
13. *Dolor*

13. *Dolor brachii in hydrope* Pain of the arm in dropsy
pectoris. of the chest.
14. *Diarrhœa a dentitione.* Diarrhœa from toothings.

GENUS III.

Catenated with Voluntary Motions.

SPECIES.

- | | |
|--------------------------------|-----------------------|
| 1. <i>Titubatio linguæ.</i> | Impediment of speech. |
| 2. <i>Chorea sancti viti.</i> | St. Vitus' dance. |
| 3. <i>Rifus.</i> | Laughter. |
| 4. <i>Tremor ex irâ.</i> | Trembling from anger. |
| 5. <i>Rubor ex irâ.</i> | Redness from anger. |
| 6. ——— <i>criminati.</i> | Blush of guilt. |
| 7. <i>Tarditas paralytica,</i> | Slowness from palsy. |
| 8. ——— <i>senilis.</i> | ———— of age. |

GENUS IV.

Catenated with External Influences.

SPECIES.

- | | |
|---|----------------------------------|
| 1. <i>Somni periodus.</i> | Periods of sleep. |
| 2. <i>Studii inanis periodus.</i> | ———— of reverie. |
| 3. <i>Hemicranîæ periodus.</i> | ———— of head-ach. |
| 4. <i>Epilepsiæ dolorificæ pe-</i>
<i>riodus.</i> | ———— of painful epilepsy. |
| 5. <i>Convulsionis dolorificæ</i>
<i>periodus.</i> | ———— of painful convul-
sion. |
| 6. <i>Tussis periodicæ periodus.</i> | ———— of periodic cough. |

7. *Catamenia periodus.* Periods of catamenia.
 8. *Hæmorrhoidis periodus.* ——— of the piles.
 9. *Podagra periodus.* ——— of the gout.
 10. *Erysipelatis periodus.* ——— of erysipelas.
 11. *Febrium periodus.* ——— of fevers.

ORDO III.

Retrograde Associate Motions.

GENUS I.

Catenated with Irritative Motions.

SPECIES.

1. *Diabætes irritata.* Diabetes from irritation.
 2. *Sudor frigidus in asth-* Cold sweat in asthma.
 mate.
 3. *Diabætes a timore.* Diabetes from fear.
 4. *Diarrhæa a timore.* Diarrhœa from fear.
 5. *Pallor et tremor a ti-* Paleness and trembling from
 more. fear.
 6. *Palpitatio cordis a ti-* Palpitation of the heart
 more. from fear.
 7. *Abortio a timore.* Abortion from fear.
 8. *Hysteria a timore.* Hysterics from fear.

GENUS

GENUS II.

Catenated with Sensitive Motions.

SPECIES.

- | | |
|------------------------------------|----------------------------|
| 1. <i>Nausea idealis.</i> | Nausea from ideas. |
| 2. ———— <i>a conceptu.</i> | Nausea from conception. |
| 3. <i>Vomitio vertiginosa.</i> | Vomiting from vertigo. |
| 4. ———— <i>a calculo in ure-</i> | ————— from stone in the |
| <i>tere.</i> | ureter. |
| 5. ———— <i>ab insultu para-</i> | ————— from stroke of pal- |
| <i>lytico.</i> | sy. |
| 6. ———— <i>a titillatione fau-</i> | Vomiting from tickling the |
| <i>cium.</i> | throat. |
| 7. ———— <i>cute sympathetica.</i> | ————— from sympathy |
| | with the skin. |

GENUS III.

Catenated with voluntary Motions.

SPECIES.

- | | |
|---------------------------------|---------------------|
| 1. <i>Ruminatio.</i> | Rumination. |
| 2. <i>Vomitio voluntaria.</i> | Voluntary vomiting. |
| 3. <i>Eructatio voluntaria.</i> | ————— eructation. |

GENUS

GENUS IV.

Catenated with external Influences.

SPECIES.

1. *Catarrhus periodicus.* Periodical catarrh.
2. *Tussis periodica.* Periodic cough.
3. *Hysteria a frigore.* Hysterics from cold.
4. *Nausea pluvialis.* Sicknes against rain.

CLASS

CLASS IV.

DISEASES OF ASSOCIATION.

ORDO I.

Increased Associate Motions.

GENUS I.

Catenated with Irritative Motion.

THE importance of the subsequent class not only consists in its elucidating all the sympathetic diseases, but in its opening *a road to the knowledge of fever*. The difficulty and novelty of the subject must plead in excuse for the present imperfect state of it. The reader is entreated previously to attend to the following circumstances for the greater facility of investigating their intricate connections; which I shall enumerate under the following heads.

- A. Associate motions distinguished from catenations.
- B. Associate motions of three kinds.
- C. Affociations affected by external influences.
- D. Affociations affected by other sensorial motions.
- E. Affociations catenated with sensation.
- F. Direct and reverse sympathy.
- G. Affociations affected four ways.
- H. Origin of affociations.
- I. Of the action of vomiting.
- K. Tertian affociations.

A. Associate

A. Associate Motions distinguished from Catenations.

Associate motions properly mean only those, which are caused by the sensorial power of association. Whence it appears, that those fibrous motions, which constitute the introductory link of an associate train of motions, are excluded from this definition, as not being themselves caused by the sensorial power of association, but by irritation, or sensation, or volition. I shall give for example the flushing of the face after dinner; the capillary vessels of the face increase their actions in consequence of their catenation, not their association, with those of the stomach; which latter are caused to act with greater energy by the irritation excited by the stimulus of food. These capillaries of the face are associated with each other reciprocally, as being all of them excited by the sensorial power of association; but they are only catenated with those of the stomach, which are not in this case associate motions but irritative ones. The common use of the word association for almost every kind of connection has rendered this subject difficult; from which inaccuracy I fear some parts of this work are not exempt.

B. Associate Motions of three Kinds.

These trains or tribes of associate motions, whose introductory link consists of an irritative motion, are termed irritative associations; as when the muscles of the eyelids close the eye in common nictitation. Those, whose introductory link consists of a sensitive motion,

motion, are termed sensitive associations; as when the pectoral and intercostal muscles act in sneezing. And lastly, those, whose introductory link consists of a voluntary motion, are termed voluntary associations; as when the muscles of the lower limbs act in concert with those of the arm in fencing.

C. Associations affected by external Influences.

Circles of associate motions, as well as trains and tribes of them, are liable to be affected by external influences, which consist of ethereal fluids, and which, by penetrating the system, act upon it perhaps rather as a *causa sine qua non* of its movements, than directly as a stimulus; except when they are accumulated in unusual quantity. We have a sense adapted to the perception of the excess or defect of one of these fluids; I mean that of elementary heat; in which all things are immersed. See Class IV. 1. 4. 1. But there are others of them, which as we have no power to evade their influence, so we have no sense to perceive it; these are the solar, and lunar, and terrestrial gravitation, in which also all things are immersed; the electric aura, which pervades us, and is perpetually varying, See Class IV. 1. 4. 5; the magnetic fluid, Class IV. 1. 4. 6; and lastly, the great life-preserver oxygen gas, and the aqueous vapour of the atmosphere, see Class IV. 1. 4. 6. and 7. and 2.

Of these external influences those of heat, and of gravity, have diurnal periods of increase and decrease; besides their greater periods of monthly or
annual

annual variation. The manner in which they act by periodical increments on the system, till some effect is produced, is spoken of in Sect. XXXII. 3. and 6.

D. Associations affected by other Sensorial Motions.

Circles and trains of associate motions are also liable to be affected by their catenations with other sensorial powers, as of irritation, or sensation, or volition; which other sensorial powers either thus simply form some of the links of the catenation, or add to the energy of the associated motions. Thus when vomiting is caused by the stimulus of a stone in the ureter, the sensation of pain seems to be a link of the catenation rather than an efficient cause of the vomiting. But when the capillary vessels of the skin increase their action from the influence of external heat, they are excited both by the stimulus of unusual heat, as well as by the stimulus of the blood, and by their accustomed association with the actions of the heart and arteries. And lastly, in the blush of anger the sensorial power of volition is added to that of association, and irritation, to excite the capillaries of the face with increased action. See Class IV. 2. 3. 5.

E. Associations catenated with Sensation.

Pain frequently accompanies associate trains or circles of motion without its being a cause, or a link, of them, but simply an attendant symptom; though it frequently gives name to the disease, as head-ach. Thus in the cramp of the calves of the legs in diarrhoea,

rhœa, the increased sensorial power of association is the proximate cause; the preceding increased action of the bowels is the remote cause; and the proximate effect is the violent contractions of the muscoli gastrocnemii; but the pain of these muscles is only an attendant symptom, or a remote effect. See Sect. XVIII. 15. Other sensitive associations are mentioned in Class IV. 1. 2. and IV. 1. 2. 15.

Thus, if the flushing of the face above mentioned after dinner be called a disease, the immediate or proximate cause is the increased power of association, the remote cause is the increased irritative motions of the stomach in consequence of the stimulus of food and wine. The disease or proximate effect consists in the increased actions of the cutaneous vessels of the face; and the sensation of heat, the existence of heat, and the red colour, are attendants or symptoms, or remote effects, of the increased actions of these cutaneous vessels.

F. *Direct and reverse Sympathy.*

The increased actions of the primary part of the trains of associated motions are sometimes succeeded by increased actions of the secondary part of the train; and sometimes by decreased actions of it. So likewise the decreased actions of the primary part of a train of associate motions are sometimes succeeded by decreased actions of the secondary part, and sometimes by increased actions of it. The former of these situations is called direct sympathy, and the latter reverse sympathy.

sympathy. In general I believe, where the primary part of the train of associated motions is exerted more than natural, it produces direct sympathy in strong people, and reverse sympathy in weak ones, as a full meal makes some people hot, and others chill. And where the primary part of the train is exerted less than natural, it produces direct sympathy in weak people, and reverse sympathy in strong ones, as on being exposed for a certain length of time on horse-back in a cold day gives indigestion and consequent heart-burn to weak people, and strengthens the digestion, and induces consequent hunger, in strong ones. See Sect. XXXV. 1.

This may perhaps be more easily understood, by considering strength and weakness, when applied to animal bodies, as consisting in the quantity of sensorial power residing in the contracting fibres, and the quantity of stimulus applied, as shewn in Sect. XII. 2. 1. Now when defective stimulus, within certain limits, is partially applied to parts subject to perpetual motion, the expenditure of sensorial power is for a while lessened, but not its general production in the brain, nor its derivation into the weakly-stimulated part. Hence in strong people, or such whose fibres abound with sensorial power, if the first tribe of an associate train of motions be deprived in part of its accustomed stimulus, its action becomes diminished; and the sensorial power becomes accumulated, and by its superabundance, or overflowing as it were, increases the action of the second tribe of the associate actions by reverse

reverse sympathy. As exposing the warm skin for a moderate time to cold air increases the action of the stomach, and thus strengthens the power of digestion.

On the reverse, when additional stimulus within certain limits is partially applied to parts, which are deficient in respect to the natural quantity of sensorial power, the expenditure of sensorial power is increased, but in a less degree than the increased production of it in the brain, or its increased derivation into the strongly-stimulated organ. Hence in weak people, or such whose fibres are deficient of sensorial power, if the first tribe of an associate train of motions be subjected for a while to greater stimulus than usual, a greater production of sensorial power, or a greater derivation of it into the stimulated parts occurs; which by its excess, or overflowing as it were, increases the actions of the second tribe of the associate motions by direct sympathy. Thus when vomiting occurs with cold extremities, a blister on the back in a few hours occasions universal warmth of the skin, and stops the vomiting. And when a diarrhoea occurs with pale skin and cold extremities, the pricking of the points of a flannel shirt, worn next the skin, occasions universal warmth of it, and checks or cures the diarrhoea.

In some associate trains of action nevertheless reverse sympathies more frequently occur than direct ones, and in others direct ones more frequently than reverse ones. Thus in continued fever with debility there appears to be a reverse sympathy between the

capillary vessels of the stomach and those of the skin; because there exists a total aversion to solid food, and constant heat on the surface of the body. Yet these two systems of vessels are at other times actuated by direct sympathy, as when paleness attends sickness, or cold feet induces indigestion. This subject requires to be further investigated, as it probably depends not only on the present or previous plus or minus of the sensorial power of association, but also on the introduction of other kinds of sensorial power, as in Class IV. 1. 1. D; or the increased production of it in the brain, or the greater mobility of one part of a train of actions than another.

Thus when much food or wine is taken into the stomach, if there be no superfluity of sensorial power in the system, that is, none to be spared from the continual actions of it, a paleness and chillness succeeds for a time; because now the expenditure of it by the increased actions of the stomach is greater than the present production of it. In a little time however the stimulus of the food and wine increases the production of sensorial power in the brain, and this produces a superfluity of it in the system; in consequence of which the skin now becomes warm and florid, which was at first cold and pale; and thus the reverse sympathy is shortly converted into a direct one; which is probably owing to the introduction of a second sensorial power, that of pleasurable sensation.

On the contrary, when an emetic drug produces sickness, the skin is at first pale for a time by direct sympathy

sympathy with the capillaries of the stomach ; but in a few minutes, by the accumulation of sensorial power in the stomach during its less active state in sickness, the capillaries of the skin, which are associated with those of the stomach, act with greater energy by reverse sympathy, and a florid colour returns. Where the quantity of action is diminished in the first part of a train of motions, whether by previous diminution of sensorial power, or present diminution of stimulus, the second part of the train becomes torpid by direct sympathy. And when the quantity of action of the first part becomes increased by the accumulation of sensorial power during its previous torpor, or by increase of stimulus, the actions of the second part of it likewise become increased by direct sympathy.

In moderate hunger the skin is pale, as before dinner, and in moderate sickness, as no great accumulation of sensorial power has commenced ; but in violent hunger, and in greater torpor of the stomach, as from contagious matter, the accumulation of sensorial power becomes so great as to affect the arterial and capillary system, and fever is produced in both cases.

In contagious fevers with arterial debilities commencing with torpor of the stomach, why is the action of the heart weakened, and that of the capillaries increased ? Is it because the mobility of the heart is less than that of the stomach, and the mobility of the capillaries greater ? Or is it because the association between the muscular fibres of the stomach and those of the heart have been uniformly associated by direct

sympathy; and the capillaries of the stomach and those of the skin have been more frequently associated by reverse sympathy?

Where the actions of the stomach have been previously exhausted by long stimulus, as on the day after intoxication, little or no accumulation of sensorial power occurs, during the torpor of the organ, beyond what is required to replace the deficiency of it, and hence fever seldom follows intoxication. And a repetition of the stimulus sometimes becomes necessary even to induce its natural action, as in dram-drinkers.

Where there has been no previous exhaustion of sensorial power, and the primary link of associate motions is violently actuated by the sensorial power of sensation, the secondary link is also violently actuated by direct sympathy, as in inflammatory fevers. Where however the sensorial power of the system is less than natural, the secondary link of associated motions becomes torpid by reverse sympathy, as in the inoculated small-pox during the eruption on the face the feet are frequently cold.

G. *Associations affected four Ways.*

Hence associated trains or circles of motions may be affected four different ways. 1. By the greater or less energy of action of the first link with which they are catenated, and from which they take their names; as irritative, sensitive, or voluntary associations. 2. By being excited by two or more sensorial powers at the same time, as by irritation and association, as in
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the instance of the application of the stimulus of increased external heat to the cutaneous capillaries. 3. By catenation with other sensorial powers, as with pain or pleasure, which are in this case not the proximate cause of motion, but which, by becoming a link of catenation, excites the sensorial power of association into action; as the pain at the neck of the gall-bladder occasioned by a gall-stone is transferred to the other end of that canal, and becomes a link of catenation between the action of the two extremities of it. 4. The influence of ethereal fluids, as of heat and gravitation. To which last perhaps might be added moisture and oxygen gas as constituting necessary parts of the system, rather than stimuli to excite it into action.

H. *The Origin of Associations.*

Some trains or circles of associate motions must have been formed before our nativity, as those of the heart, arteries, and capillaries; others have been associated, as occasion required them, as the muscles of the diaphragm and abdomen in vomiting; and others by perpetual habit, as those of the stomach with the heart and arteries directly, as in weak pulse during sickness; with the capillaries directly, as in the flushed skin after dinner; and lastly, with the cellular absorbents reversely, as in the increased absorption in anasarca during sickness; and with the irritative motions of the organs of sense reversely, as in vertigo, or sea-sickness. Some of these associations shall be here shortly described to facilitate the investigation of others.

First, other congeries of glands occupy but a particular part of the system, or constitute a particular organ, as the liver, or kidneys; but those glands, which secrete the mucus, and perspirable matter, which are called capillaries, are of very great extent; they receive the blood from the arteries, separate from it the mucus, which lines every cell, and covers every cavity of the body; and the perspirable matter, which softens and lubricates the whole surface of the skin, and the more extensive surface of the air-vessels, which compose the lungs. These are supplied with blood by the perpetual action of the heart and arteries, and have therefore their motions associated with the former, and with each other, by sympathy, which is sometimes direct, and sometimes reverse.

One branch of this association, the capillaries of the skin, are very irritable by the increased quantities of cold and heat, another branch, that of the lungs, has not the perception of cold and heat, but is liable by direct sympathy to act in concert with the former, as in going into the cold bath. And it is probable the capillaries of the internal membranes are likewise directly affected by their sympathy with those of the skin, as appears from the defect of secretion in ulcers during the cold fits of agues.

The motions of this extensive system of capillaries, thus associated by direct sympathy, are also associated with those of the heart and arteries, sometimes by reverse and sometimes by direct sympathy; and thus constitute simple fever. The cold paroxysm of which consists,

consists in their torpor, and the hot one in their orgasm, or increased activity.

I. *Of the Action of Vomiting.*

The manner, in which the stomach and the diaphragm and abdominal muscles acquire their associate action in vomiting, requires some attention. It is not probable, that this action of vomiting occurs before nativity; as the uniform application of the nutritive liquor amnii to the mouth of the foetus, and the uniform expenditure of its nourishment, would not seem to give occasion to too great temporary repletion of the stomach; and would preclude the deglutition of any improper material. After nativity the stomach of the child may be occasionally too much distended with milk; as previous hunger may induce it to overgorge itself; and by repeated efforts the act of vomiting is learned, as a means of getting free from a disagreeable sensation. Thus when any disgusting material, as a bitter drug, is taken into the mouth; certain retrograde motions of the tongue and lips are produced, for the purpose of putting the disagreeable material out of the mouth again.

When the stomach is disagreeably stimulated by the distention or acrimony of the aliment, a similar effort to regurgitate it must occur; and by repeated trials the action of the diaphragm and abdominal muscles by squeezing the stomach assists its retrograde exertion to disgorge its contents. In the same manner when a piece of gravel is pushed into the urethra, or a piece

of indurated bile into the neck of the gall-bladder, after they have been in vain pressed forward by the usual motions of those ducts, they return into the bladders of gall and urine by the retrograde motions of them.

That this is one mode, in which vomiting is induced, appears from the instantaneous rejection from the stomach occasioned by some nauseous drug, or from some nauseous idea; and lastly, from the voluntary power, which some people have been said to have acquired, of emptying their stomachs, much in the same manner as ruminating animals bring up the grass from their first stomach.

There are nevertheless many modes by which these inverted motions of the stomach and œsophagus are induced, and which it is of consequence to distinguish from each other. The first is the mode above described, where an effort is made to dislodge something, which stimulates the stomach into disagreeable sensation; and which is returned by repeated exertions; as when a nauseous drug is taken into the mouth, or a bit of sand falls into the eye, or a drop of water into the wind-pipe. In this the peristaltic motions of the stomach are first stopped, and then reverted by painful sensation; and the abdominal muscles and diaphragm by repeated efforts become associated with them. Now as less sensorial power is expended on the retrograde actions of the stomach, and of the lymphatics, which open their mouths on its surface, than by their natural motions, an accumulation of sensorial power
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in the fibres of the stomach follows the exhibition of an emetic; and on that account an emetic will sometimes stop a spontaneous vomiting which was owing to sensorial deficiency. See Sect. XXXV. 1. 3. and Art. V. 2. 1.

As bitters and metallic salts, exhibited in small doses, stimulate the stomach into greater action, as appears by their increasing the power of digestion, and yet become emetic, when given in larger doses; one might suspect, that they became emetic by inducing debility, and consequent retrograde actions of the stomach, by their previously exhausting the sensorial power by their great stimulus; which might be effected in a moment without producing pain, and in consequence without our perceiving it. But on the contrary, there does not in general appear on the exhibition of emetics to be any previous exhaustion of sensorial power; because there is evidently an accumulation of it during the sickness, as appears from the digestion being stronger afterwards; and from the increased action of the cellular and cutaneous absorbents during its operation. See Art. V. 2. 1.

Another mode, by which vomiting is induced, is owing to debility or deficiency of sensorial power, from the previous exhaustion of it; as on the day after intoxication, or which occurs in people enfeebled with the gout, and in dropsy, and in some fevers with debility. In these, when the vomiting ceases, there is no appearance of accumulation of sensorial power, as the digestion still remains weak and imperfect.

Another

Another mode by which sickness or vomiting is induced, is by defect of stimulus, as in great hunger; and in those, who have been habituated to spice and spirit with their meals, who are liable to be sick after taking food without these additional stimuli. Other means of inducing sickness by vertigo, or by nauseous ideas, will be mentioned below.

We shall only add, that the motions of the muscular fibres of the stomach are associated with those of the heart and arteries by direct sympathy, as appears by the weakness of the pulse during the exhibition of an emetic; and that the absorbents of the stomach are associated with the cellular and cutaneous absorbents by reverse sympathy, as is shewn by the great absorption of the mucus of the cells in anasarca during sickness; at the same time that the absorbents of the stomach invert their actions, and pour the mucus and water thus absorbed into that viscus.

In cold paroxysms of fever the stomach partakes of the general torpor, and vomiting is induced by its debility, either by its association with the torpid capillaries, or other torpid parts, or by its own torpor commencing first, and causing the cold fit. The disordered motions of the stomach frequently seem to be the cause or primary seat of fever, as where contagious miasmata are swallowed with the saliva, and where fever is produced by sea-sickness, which I once saw. Nevertheless a disorder of the stomach does not always induce fever, as in that case it should constantly attend indigestion, and vertigo, and sea-sickness; but

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is itself frequently induced by association with the disordered movements of other parts of the system, as when it arises from gravel in the ureter, or from a percussion on the head.

The connexion of the motions of the stomach with irritative ideas, or motions of the organs of sense, in vertigo, is shewn in Sect. XX. and thus it appears, that many circles of association are either directly or reversely associated, or catenated, with this viscus; which will much contribute to unfold some of the symptoms of fever.

K. *Tertian Associations.*

The third link of associate trains of motion is sometimes actuated by reverse sympathy with the second, link, and that by reverse sympathy with the first link; so that the first and third link may act by direct sympathy, and the intermediate one by reverse sympathy: Of this instances are given in the syngultus nephriticus, Class IV. 1. 1. 7. and IV. 2. 1. At other times the tertian or quartan links of associate motions are actuated by direct sympathy; and that sometimes forwards and sometimes backwards in respect to the usual order of those trains of associate motions, as in Class IV. 1. 2. 1.

SPECIES.

1. *Rubor vultus pransorum.* Flushing of the face after dinner is explained in Sect. XXXV. 1. In the beginning of intoxication the whole skin becomes florid from the association of the actions of the cutaneous arteries

arteries with those of the stomach, because vinous spirit excites the fibres of the stomach into more violent action than the stimulus of common food; and the cutaneous capillaries of the face, from their more frequent exposure to the vicissitudes of cold and heat, possess more mobility or irritability than those of other parts of the skin, as further explained in Sect. XXXIII. 2. 10. Vinegar is liable to produce this flushing of the face, which probably is owing to the quantity of vinous spirit it contains, as I believe the unfermented vegetable acids do not produce this effect. In every kind of blush the arterial blood is propelled into the capillaries faster than the venous absorption can carry it forwards into the veins, in this respect resembling the *tensio phalli*.

Can the beginning vinous or acetous fermentation of the aliment in weak stomachs contribute to this effect? or is it to be ascribed to the greater power of association between the arteries of the face and the fibres of the stomach in some people than in others?

M. M. Eat and drink less at a time, and more frequently. Put 20 drops of weak acid of vitriol into water to be drank at meals. Let the dress over the stomach and bowels be loose. Use no fermented liquors, or vinegar, or spice.

2. *Sudor stragulis immerforum*. Sweat from being covered in bed. In the commencement of an epidemic fever, in which the perpetual efforts to vomit was a distressing symptom, Dr. Sydenham discovered, that

if the patient's head was for a short time covered over with the bed clothes, warmth was produced, and a sweat broke out upon the skin, and the tendency to vomit ceased. In this curious fact two trains of associated motions are excited into increased action. First, the vessels of the lungs are known to have their motion associated with those of the skin by the difficulty of breathing on going into the cold bath, as described in Sect. XXXII. 3. 2. Hence, when the vessels of the lungs become excited into stronger action, by the bad air under the bed clothes, warmed and adulterated by frequent breathing, those of the external skin soon become excited by their association into more energetic action, and generate more heat along with a greater secretion of perspirable matter. Secondly, the sympathy between the stomach and skin is evident in variety of circumstances; thus the cold air of frosty days applied to the skin for a short time increases the action of the stomach by reverse sympathy, but decreases it if continued too long by direct sympathy; so in the circumstance above mentioned the action of the stomach is increased by direct sympathy with that of the skin; and the tendency to vomit, which was owing to its diminished action, ceases.

3. *Cessatio ægritudinis cute excitatâ.* The cure of sickness by stimulating the skin. This is explained in the preceding article; and further noticed in IV. 2. 2. 4. and in IV. 1. 1. f.

Similar

Similar to these is the effect of a blister on the back in relieving sickness, indigestion, and heart-burn; and, on the contrary, by these symptoms being frequently induced by coldness of the extremities. The blister stimulates the cutaneous vessels into greater action; whence warmth and pain are produced at the same time, and the fibres of the stomach are excited into greater action by their association with those of the skin. It does not appear, that the concomitant pain of the blister causes the increased energy of the stomach, because the motions of it are not greater than natural; though it is sometimes difficult to determine, whether the primary part of some associated trains be connected with irritative or sensitive motions.

In the same manner a flannel shirt, to one who has not been in the habit of wearing one, stimulates the skin by its points, and thus stops vomiting in some cases; and is particularly efficacious in checking some chronic diarrhoeas, which are not attended with fever; for the absorbents of the skin are thus stimulated into greater action, with which those of the intestines consent by direct sympathy.

This effect cannot be ascribed to the warmth alone of the flannel shirt, as being a covering of loose texture, and confining air in its pores, like a sponge, which air is known to be a bad conductor of heat, since in that case its use should be equally efficacious, if it were worn over a linen shirt; and an increased warmth of the room of the patient would be equally serviceable.

4. *Digestio aucta frigore cutaneo.* Digestion increased by coldness of the skin. Every one has experienced the increase of his appetite after walking in the cool air in frosty days; for there is at this time not only a saving of sensorial power by the less exertion of the cutaneous vessels; but, as these consent with those of the stomach and bowels, this saving of sensorial power is transferred by reverse sympathy from the cutaneous capillaries and absorbents to those of the stomach and intestines.

Hence weak people should use the cold air of winter as a cold bath; that is, they should stay in it but a short time at once, but should immerse themselves in it many times a day.

5. *Catarrhus a frigore cutaneo.* Catarrh from cold skin. This has been already explained in Class I. 1. 2. 7. and is further described in Sect. XXXV. 1. 3. In this disease the vessels of the membrane, which lines the nostrils, are excited into greater action; when those of the skin, with which they are associated, are excited into less action by the deficiency of external heat, by reverse sympathy; and though the pain of cold attends the torpor of the primary link of this association, yet the increased motions of the membrane of the nostrils are associated with those of the cutaneous vessels, and not with the pain of them, because no inflammation follows.

6. *Absorptio cellularis aucta vomitu.* In the act of vomiting the irritative motions of the stomach are inverted,

inverted, and of the absorbents, which open their mouths into it; while the cutaneous, cellular, and pulmonary absorbents are induced, by reverse sympathy with them, to act with greater energy. This is seen in cases of anasarca, when long sickness and vomiting are caused by squills, or antimonial salts, or most of all by the decoction of digitalis purpurea, foxglove; and Mr. J. Hunter mentions a case, in which a large bubo, which was just ready to break, was absorbed in a few days by sickness at sea. Treatise on the blood, p. 501, which is thus accounted for; less sensorial power is expended during sickness by the decreased action of the fibres of the stomach, and of its absorbents; as shewn in Sect. XXXV. 1. 3. whence an accumulation of it is produced, and there is in consequence a greater quantity of sensorial power for the exertion of those motions, which are associated with the absorbents of the stomach by reverse sympathy.

The reverse sympathy between the lacteal and lymphatic branches of the absorbent system have been produced by the one branch being less excited to act, when the other supplies sufficient fluid or nutriment to the sanguiferous vessels. Thus when the stomach is full, and the supply of chyle and mucus and water is in sufficient quantity; the pulmonary, cellular, and cutaneous lymphatics are not excited into action; whence the urine is pale, and the skin moist, from the defect of absorption on those surfaces.

7. *Syngultus nephriticus*. When a stone irritates the ureter, and that even without its being attended

with pain or fever, sometimes a chronical hiccough occurs, and continues for days and weeks, instead of sickness or vomiting; which are the common symptoms. In this case the motions of the stomach are decreased by their sympathy with those of the ureter, which are increased by the stimulus of the stone in it; and the increased motions of the diaphragm seem to exist in consequence of their association with the stomach by a second reverse sympathy. This hiccough may nevertheless admit of another explanation, and be supposed to be a convulsive exertion of the diaphragm to relieve the disagreeable sensation of the stomach in consequence of its disordered irritative associations; and in that case it would belong to Class III. 1. 1. See Class IV. 2. 1. for another example of tertiary association.

M. M. Venesection. Emetic. Calomel. Cathartic, opium, oil of cinnamon from two to ten drops. Aerated alkaline water. Peruvian bark.

8. *Febris irritativa*. Irritative fever, described in Class I. 1. 1. 1. The diseases above explained in this genus are chiefly concerning the sympathies of the absorbent system, or the alimentary canal, which are not so much associated with the arterial system, as to throw it into disorder, when they are slightly deranged; but when any great congeries of conglomerate glands, which may be considered as the extremities of the arterial system, are affected with torpor, the whole arterial system and the heart sympa-

thize with the torpid glands, and act with less energy; which constitutes the cold fit of fever; which is therefore at first a decreased action of the associate organ; but as this decrease of action is only a temporary effect, and an increase of exertion both of the torpid glands, and of the whole arterial system, soon follows; the hot fit of irritative fever, or fever with strong pulse, properly belongs to this class and genus of diseases.

ORDO I.

Increased Associate Motions.

GENUS II.

Catenated with Sensitive Motions.

THE primary links of the associated actions of this genus are either produced or attended by painful or pleasurable sensation. The secondary links of the first ten species are attended with increased motions without inflammation, those of the remainder are attended with inflammation. All inflammations, which do not arise in the part which was previously torpid, belong to this genus; as the gout, rheumatism, erysipelas. It is probable many other inflammations may, by future observation, require to be transplanted into this class.

The circles of sensitive associate motions consist chiefly of the excretory ducts of the capillaries and of the

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the mouths of the absorbent vessels, which constitute the membranes; and which have been induced into action at the same time; or they consist of the terminations of canals; or of parts which are endued with greater sensibility than those which form the first link of the association. An instance of the first of those is the sympathy between the membranes of the alveolar processes of the jaws, and the membranes above or beneath the muscles about the temples in hemicrania. An instance of the second is in the sympathy between the excretory duct of the lacrymal gland, and the nasal duct of the lacrymal sac. And an instance of the third is the sympathy between the membranes of the liver, and the skin of the face in the gutta serena of inebriates.

S P E C I E S.

1. *Lacrymarum fluxus sympatheticus.* A flow of tears from grief or joy. When the termination of the duct of the lacrymal sac in the nostrils becomes affected either by painful or pleasurable sensations, in consequence of external stimulus, or by its association with agreeable or disagreeable ideas, the motions of the lacrymal gland are at the same time exerted with greater energy, and a profusion of tears succeeds by sensitive association, as explained in Sect. XVI. 8. 2.

In this case there exists a chain of associated actions, the secretion of the lacrymal gland is increased by whatever stimulates the surface of the eye, at the same time the increased abundance of tears stimulates the

puncta lacrymalia into greater action; and the fluid thus absorbed stimulates the lacrymal sac, and its nasal duct in the nose into greater action. In a contrary direction of this chain of association the present increase of action is induced. First, the nasal duct of the lacrymal sac is excited into increased action by some pleasurable or painful idea, as described in Sect. XVI. 8. 2. 2d. The puncta lacrymalia or other extremity of the lacrymal sac sympathizes with it (as the two ends of all other canals sympathize with each other). 3d. With these increased motions of the puncta lacrymalia those of the excretory duct of the lacrymal gland are associated from their having so perpetually acted together. And, lastly, with the increased actions of the excretory duct of this gland are associated those of the other end of it by their frequently acting together; in the same manner as the extremities of other canals are associated; and thus a greater flow of tears is poured into the eye.

When a flow of tears is produced in grief, it is believed to relieve the violence of it, which is worthy a further inquiry. Painful sensations, when great, excite the faculty of volition; and the person continues voluntarily to call up or perform those ideas, which occasion the painful sensation; that is, the afflicted person becomes so far insane or melancholy; but tears are produced by the sensorial faculty of association, and shew that the pain is so far relieved as not to excite the excessive power of volition, or insanity, and are therefore a sign of the abatement of the
painful

painful state of grief, rather than a cause of that abatement. See Class III. 1. 2. 10.

2. *Sternutatio a lumine.* Some persons sneeze from looking up at the light sky in a morning after coming out of a dark bed-room. The olfactory nerves are brought into too great action by their sympathy with the optic nerves, or by their respective sympathies with some intervening parts, as probably with the two extremities of the lacrymal sac; that is, with the puncta lacrymalia and the nasal duct. See Class II. 1. 1. 3.

3. *Dolor dentium stridore.* Tooth-edge from grating sounds, and from the touch of certain substances, and even from imagination alone, is described and explained in Sect. XVI. 10. The increased actions of the alveolar vessels or membranes are associated with the ideas, or sensual motions of the auditory nerves in the first case; and of those of the sense of touch, in the second case; and by imagination, or ideas exerted of painful sensation alone, in the last.

4. *Risus sardonius.* A disagreeable smile attends inflammations of the diaphragm arising from the associations of the reiterated exertions of that muscle with those of the lips and cheeks in laughing. See Diaphragmitis, Class II. 1. 2. 6.

5. *Salivæ fluxus cibo viso.* The flow of saliva into the mouths of hungry animals at the sight or smell of

food is seen in dogs standing round a dinner-table. The increased actions of the salivary glands have been usually produced by the stimulus of agreeable food on their excretory ducts during the mastication of it; and with this increased action of their excretory ducts the other terminations of those glands in the capillary arteries have been excited into increased action by the mutual association of the ends of canals; and at the same time the pleasurable ideas, or sensual motions, of the sense of smell and of sight have accompanied this increased secretion of saliva. Hence this chain of motions becomes associated with those visual or olfactory ideas, or with the pleasure, which produces or attends them.

6. *Tensio mammularum viso puerulo.* The nipples of lactescent women are liable to become turgid at the sight of their young offspring. The nipple has generally been rendered turgid by the titillation of the lips or gums of the child in giving suck; the visible idea of the child has thus frequently accompanied this pleasurable sensation of parting with the milk, and turgescence of the tubes, which constitute the nipple. Hence the visual idea of the child, and the pleasure which attends it, become associated with those increased arterial actions, which swell the cells of the mammula, and extend its tubes; which is very similar to the *tensio phalli visâ muliere nudâ etiam in insomnio.*

7. *Tensio penis in hydrophobia.* An erection of the penis occurs in the hydrophobia, and is a troublesome symptom,

symptom, as observed by Cœlius Aurelianus, Fothergill, and Vaughn, and would seem to be produced by an unexplained sympathy between the sensations about the fauces and the penis. In men the hair grows about both these parts, the voice changes, and the neck thickens at puberty. In the mumps, when the swellings about the throat subside, the testicles are liable to swell. Venereal infection received by the penis is very liable to affect the throat with ulcers. Violent coughs, with soreness or rawness about the fauces are often attended with erection of the penis; which is also said to happen to male animals, that are hanged; which last circumstance has generally been ascribed to the obstruction of the circulation of the blood, but is more probably occasioned by the stimulus of the cord in compressing the throat; since if it was owing to impeded circulation it ought equally to occur in drowning animals.

In men the throat becomes so thickened at the time of puberty, that a measure of this is used to ascertain the payment of a poll-tax on males in some of the islands of the Mediterranean, which commences at puberty; a string is wrapped twice round the thinnest part of the neck, the ends of it are then put one into each corner of the mouth; and if, when thus held in the teeth, it passes readily over the head, the subject is taxable.

It is difficult to point out by what circumstance the sensitive motions of the penis and of the throat and nose become associated; I can only observe, that these

parts are subjected to greater pleasurable sensations than any other parts of the body; one being designed to preserve ourselves by the pleasure attending the smell and deglutition of food, and the other to ensure the propagation of our species; and may thus gain an association of their sensitive motion by their being eminently sensible to pleasure. See Class I. 3. 1. 11. and III. 1. 1. 15. and Sect. XVI. 5.

In the female sex this association between the face, throat, nose, and pubis does not exist; whence no hair grows on their chins at the time of puberty, nor do their voices change, or their necks thicken. This happens probably from there being in them a more exquisite sensitive sympathy between the pubis and the breasts. Hence their breasts swell at the time of puberty, and secrete milk at the time of parturition. And in the parotitis, or mumps, the breasts of women swell, when the tumor of the parotitis subsides. See Class I. 1. 2. 15. Whence it would appear, that their breasts possess an intermediate sympathy between the pubis and the throat; as they are the seat of a passion, which men do not possess, that of suckling children.

8. *Tenesmus calculosus*. The sphincter of the rectum becomes painful or inflamed from the association of its sensitive motions with those of the sphincter of the bladder, when the latter is stimulated into violent pain or inflammation by a stone.

9. *Polypus*

9. *Polypus narium ex ascaridibus?* The stimulation of ascarides in the rectum produces by sensitive sympathy an itching of the nose; as explained in IV. 2. 2. 6; and in three children I have seen a polypus in the nose, who were all affected with ascarides; to the perpetual stimulation of which, and the consequent sensitive association, I was led to ascribe the inflammation and thickening of the membrane of the nostrils.

10. *Crampus surarum in cholera.* A cramp of the muscles of the legs occurs in violent diarrhoea, or cholera, and from the use of too much acid diet in gouty habits. This seems to sympathize with uneasy sensation in the bowels. See Class III. 1. 1. 14. This association is not easily accounted for, but is analogous in some degree to the paralysis of the muscles of the arms in colica saturnina. It would seem, that the muscles of the legs in walking get a sympathy with the lower parts of the intestines, and those of the arms in variety of employment obtain a sympathy with the higher parts of them. See Cholera and Ileus.

11. *Zona ignea nephritica.* Nephritic shingles. The external skin about the loins and sides of the belly I suppose to have greater mobility in respect to sensitive association, than the external membrane of the kidney; and that their motions are by some unknown means thus associated. When the torpor or beginning inflammation of this membrane ceases, the external skin becomes inflamed in its stead, and a kind
of

of herpes, called the shingles, covers the loins and sides of the belly. See Class II. 1. 5. 9.

12. *Eruptio variolarum.* After the inflammation of the inoculated arm has spread for a quarter of a lunation, it affects the stomach by reverse sympathy; that is, the actions of the stomach are associated with those of the skin; and as much sensorial power is now exerted on the inflamed skin, the other part of this sensitive association is deprived of its natural share, and becomes torpid, or inverts its motions. After this torpor of the stomach has continued a time, and much sensorial power is thus accumulated; other parts of the skin, which are also associated with it, as that of the face first, are thrown into partial inflammation; that is, the eruptions of the small-pox appear on the face.

For that the variolous matter affects the stomach previous to its eruption on the skin appears from the sickness at the commencement of the fever; and because, when the morbid motions affect the skin, those of the stomach cease; as in the gout and erysipelas, mentioned below. The consent between the stomach and the skin appears in variety of other diseases; and as they both consist of surfaces, which absorb and secrete a quantity of moisture, their motions must frequently be produced together or in succession; which is the foundation of all the sympathies of animal motions, whether of the irritative, sensitive, or voluntary kinds.

Now

Now as the skin, which covers the face, is exposed to greater variations of heat and cold than any other part of the body; it probably possesses more mobility to sensitive associations, not only than the stomach, but than any other part of the skin; and is thence affected at the eruption of the small-pox with violent action and consequent inflammation, by the association of its motions with those of the stomach, a day before the other parts of the skin; and becomes fuller of pustules, than any other part of the body. See Class II.

I. 3. 9.

It might be supposed, that the successive swelling of the hands, when the face subsides, at the height of the small-pox, and of the feet, when the hands subside, were governed by some unknown associations of those parts of the system; but these successions of tumor and subsidence more evidently depend on the times of the eruption of the pustules on those parts, as they appear a day sooner on the face than on the hands, and a day sooner on the hands than on the feet, owing to the greater comparative mobility of those parts of the skin.

13. *Gutta rosea stomatica*. Stomatic red face. On drinking cold water, or cold milk, when heated with exercise, or on eating cold vegetables, as raw turnips, many people in harvest-time have been afflicted with what has been called a surfeit. The stomach becomes painful, with indigestion and flatulency, and after a few days an eruption of the face appears, and continues

tinues with some relief, but not with entire relief; as both the pimpled face and indigestion are liable to continue even to old age.

M. M. Venesection. A cathartic with calomel. Then half a grain of opium twice a day for many weeks. If saturated solution of arsenic three or five drops twice or thrice a day for a week?

14. *Gutta rosca hepatica.* The rosy drop of the face of some drinking people is produced like the gout described below, in consequence of an inflamed liver. In these constitutions the skin of the face being exposed to greater variation of heat and cold than the membranes of the liver, possesses more mobility than those hepatic membranes; and hence by whatever means these membranes are induced to sympathize, when this sensitive association occurs, the cutaneous vessels of the face run into greater degrees of those motions, which constitute inflammation, than previously existed in the membranes of the liver; and then those motions of the liver cease. See Class II. 1. 4. 6.

An inflammation of the liver so frequently attends the great potation of vinous spirit, there is reason to suspect, that this viscus itself becomes inflamed by sensitive association with the stomach; or that, when one termination of the bile-duct, which enters the duodenum is stimulated violently, the other end may become inflamed by sensitive association.

15. *Podagra,*

15. *Podagra*. The gout, except when it affects the liver or stomach, seems always to be a secondary disease, and, like the rheumatism and erysipelas mentioned below, begins with the torpor of some distant part of the system.

The most frequent primary seat of the gout I suppose to be the liver, which is probably affected with torpor not only previous to the annual paroxysms of the gout, but to every change of its situation from one limb to another. The reasons, which induce me to suspect the liver to be first affected, are not only because the jaundice sometimes attends the commencement of gout, as described in Sect. XXIV. 2. 8. but a pain also over the pit of the stomach, which I suppose to be of the termination of the bile-duct in the duodenum, and which is erroneously supposed to be the gout of the stomach, with indigestion and flatulency, generally attends the commencement of the inflammation of each limb. See *Arthritis ventriculi*, Class I. 2. 4. 6. In the two cases, which I saw, of the gout in the limbs being preceded by jaundice, there was a cold shivering fit attended the inflammation of the foot, and a pain at the pit of the stomach; which ceased along with the jaundice, as soon as the foot became inflamed. This led me to suspect, that there was a torpor of the liver, and perhaps of the foot also, but nevertheless the liver might also in this case be previously inflamed, as observed in Sect. XXIV. 2. 3.

Now as the membranes of the joints of the feet suffer greater variations of heat and cold than the membranes of the liver, and are more habituated to extension and contraction than other parts of the skin in their vicinity; I suppose them to be more mobile, that is, more liable to run into extremes of exertion, or quiescence; and are thence more susceptible of inflammation, than such parts as are less exposed to great variations of heat and cold, or of extension and contraction.

When a stone presses into the sphincter of the bladder, the glans penis is affected with greater pain by sympathy, owing to its greater sensibility, than the sphincter of the bladder; and when this pain commences, that of the sphincter ceases, when the stone is not too large, or pushed too far into the urethra. Thus when the membrane, which covers the ball of the great toe, sympathizes with some membranous part of a torpid or inflamed liver; this membrane of the toe falls into that kind of action, whether of torpor or inflammation, with greater energy, than those actions excited in the diseased liver; and when this new torpor or inflammation commences, that with which it sympathizes ceases; which I believe to be a general law of associated inflammations.

The paroxysms of the gout would seem to be catenated with solar influence, both in respect to their larger annual periods, and to their diurnal periods—Sect. XXXVI. 3. 6—as the former occur about the same season of the year, and the latter commence

about an hour before sun-rise; nevertheless the annual periods may depend on the succession of great vicissitudes of cold and heat, and the diurnal ones on our increased sensibility to internal sensations during sleep, as in the fits of asthma, and of some epilepsies. See Sect. XVIII. 15.

In respect to the pre-remote cause or disposition to the gout, there can be no doubt of its individually arising from the potation of fermented or spirituous liquors in this country; whether opium produces the same effect in the countries, where it is in daily use, I have never been well informed. See Sect. XXI. 10, where this subject is treated of; to which I have to add, that I have seen some, and heard of others, who have moderated their paroxysms of gout, by diminishing the quantity of fermented liquors, which they had been accustomed to; and others who, by a total abstinence from fermented liquors, have entirely freed themselves from this excruciating malady; which otherwise grows with our years, and curtails or renders miserable the latter half, or third, of the lives of those, who are subject to it. The remote cause is whatever induces temporary torpor or weakness of the system; and the proximate cause is the inirritability, or defective irritation, of some part of the system; whence torpor and consequent inflammation. The great Sydenham saw the beneficial effects of abstinence from fermented liquors in preventing the gout, and adds, “ if an empiric could give small-beer
“ only to gouty patients as a nostrum, and persuade
“ them

“ them not to drink any other spirituous fluids, that
“ he might rescue thousands from this disease, and
“ acquire a fortune for his ingenuity.” Yet it is to
be lamented, that this accurate observer of diseases
had not resolution to practise his own prescription,
and thus to have set an example to the world of the
truth of his doctrine; but, on the contrary, recom-
mends Madeira, the strongest wine in common use,
to be taken in the fits of the gout, to the detriment
of thousands; and is said himself to have perished
a martyr to the disease, which he knew how to
subdue!

As example has more forcible effect than simple
assertion, I shall now concisely relate my own case,
and that of one of my most respected friends. E. D.
was about forty years of age, when he was first seized
with a fit of the gout. The ball of his right great
toe was very painful, and much swelled and inflamed,
which continued five or six days in spite of venesection,
a brisk cathartic with ten grains of calomel, and the
application of cold air and cold water to his foot. He
then ceased to drink ale or wine alone; confining him-
self to small beer, or wine diluted with about thrice its
quantity of water. In about a year he suffered two
other fits of the gout, in less violent degree. He
then totally abstained from all fermented liquors, not
even tasting small-beer, or a drop of any kind of
wine; but eat plentifully of flesh-meat, and all kinds
of vegetables, and fruit, using for his drink at meals
chiefly water alone, or lemonade, or cream and

water; with tea and coffee between them as usual.

By this abstinence from fermented liquors he kept quite free from the gout for fifteen or sixteen years; and then began to take small-beer mixed with water occasionally, or wine and water, or perry and water, or cyder and water; by which indulgence after a few months he had again a paroxysm of gout, which continued about three days in the ball of his toe; which occasioned him to return to his habit of drinking water, and has now for above twenty years kept in perpetual health, except accidental colds from the changes of the seasons. Before he abstained from fermented or spirituous liquors, he was frequently subject to the piles, and to the gravel, neither of which he has since experienced.

In the following case the gout was established by longer habit and greater violence, and therefore required more cautious treatment. The Rev. R. W. was seized with the gout about the age of thirty-two, which increased so rapidly that at the age of forty-one he was confined to his room seven months in that year; he had some degree of lameness during the intervals, with chalky swellings of his heels and elbows. As the disease had continued so long and so violently, and the powers of his digestion were somewhat weakened, he was advised not entirely to leave off all fermented liquors; and as small-beer is of such various strength, he was advised to drink exactly two wine glasses, about four ounces, of wine mixed with three or four

times its quantity of water, with or without lemon and sugar, for his daily potation at dinner, and no other fermented liquor of any kind; and was advised to eat flesh-meat with any kind of boiled vegetables, and fruit, with or without spice. He has now scrupulously continued this regimen for above five years, and has had an annual moderate gouty paroxysm of a few weeks, instead of the confinement of so many months, with great health and good spirits during the intervals.

The following is a more particular account of the history of this case; being part of a letter which Mr. Wilmot wrote on that subject at my entreaty.

“ I entered into the army with an excellent constitution at the age of fifteen. The corps I served in was distinguished by its regularity, that is, the regular allowance of the mess was only one pint of wine per man each day; unless we had company to dine with us; then, as was the general custom of the time, the bottle circulated without limit. This mode of living, though by no means considered as excess for men, was certainly too great for a youth of my age. This style of living I continued, when with the regiment, till the latter end of the year 1769, when I had the misfortune to sleep in a damp bed at Sheffield on a journey to York, but arrived there before I felt the ill effects of it. I was then seized with a violent inflammatory rheumatism with great inflammation of my eyes, and was attended by Dr. Dealtry; so violent was the disorder, that I was bled for it eight times in
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less than a fortnight ; and was three months, before I could consider my health perfectly re-established. Dr. Dealtry told me, that I should be subject to similar attacks for many years ; and that he had no doubt, from the tendency he found in my habit to inflammation, that, when I was farther advanced in life, I should change that complaint for the gout. He predicted truly ; for the three succeeding winters I had the same complaint, but not so violently ; the fourth winter I escaped, and imputed my escape to the continuance of cold bathing during the whole of that winter ; after that I never escaped it, till I had a regular and severe fit of the gout : after the first attack of rheumatic fever I was more abstemious in my manner of living, though when in company I never subjected myself to any great restraint. In the year 1774 I had quitted the army, and being in a more retired situation, was seldom led into any excess ; in 1776 and 1777 I was in the habit of drinking a good deal of wine very frequently, though not constantly. After that period till the year 1781, I drank a larger quantity of wine regularly, but very seldom to any degree of intoxication. I lived much at that time in the society of some gentlemen, who usually drank nearly a bottle of wine daily after dinner. I must here however observe, that at no part of my life was I accustomed to drink wine in an evening, and very seldom drank any thing more than a single half-pint glass of some sort of spirits diluted with much water. Till the year 1781 I had always been accustomed to use

very violent and continued exercise on horseback; in the winter months I pursued all field diversions, and in the summer months I rode frequent and long journeys; and with this exercise was liable to perspire to great excess; besides which I was subject to very profuse night-sweats, and had frequently boils break out all over me, especially in the spring and autumn; for which I took no medicine, except a little flour of sulphur with cream of tartar in honey.

“ You will observe I bring every thing down to the date of 1781. In the month of October in that year, when I was just entered into the thirty-second year of my age, I had the first attack of gout; that fit was very severe, and of many weeks continuance. I now determined upon a more abstemious method of living, in respect to wine; and indeed the society, in which I had before been accustomed to live, being considerably changed, I had less frequent temptations to excess. From this time I enjoyed the most perfect good state of health till August 1784, when I had my second attack of gout. I never perfectly recovered from this attack through the succeeding winter, and in March 1785 was advised to try the Bath waters, and drank them under the direction of one of the faculty of that place. I was there soon seized with a fever, and a slight attack of gout in one knee. I should observe, that when I set out from home, I was in a weak and low state, and unequal to much fatigue; as appeared by my having a fainting fit one day on the road, after having travelled
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only about fifty miles ; in the course of the summer I had two or three more slight attacks of gout of less consequence, till the month of October ; when I was afflicted with it all over me in such a manner, as to be without the possibility of the least degree of removal for some days ; and was about two months without being able to get into the air. This was the severest attack I had then experienced ; though I have since had several equally severe. In the course of this summer I had a fall with my horse ; and soon after it, having discovered an enlargement on one elbow, I concluded I had hurt it at that time ; but in the course of this last attack having a similar enlargement on the other elbow, I found my mistake, and that they were collections of gouty matter ; these increased to the size of pullet's eggs, and continue in that state, I had soon after similar enlargements on my heels ; the right heel being severely bruised, I was under the necessity of having it lanced, and a large quantity of chalky matter was discharged from it ; and have since that time frequently had chalky matter taken from it, and sometimes small bits of apparently perfect chalk. My right hand soon was afflicted in the same way, and I have scarcely a joint on those fingers now in a natural state. My left hand has escaped tolerably well. After this last attack (viz. October 1785), I had two or three slight attacks before the month of June 1787, when I had a very severe intermittent fever ; from that time I continued very well till the latter end of the year, when I began

to feel the gout about me very much, but was not confined by it. I was in this state advised to try what is called the American Recipe (gum guaiacum and nitre dissolved in spirits); it had apparently been of essential service to a friend of mine, who from the inability to walk a mile for some years, was believed to be restored by the use of this medicine to a good state of health, so as to walk ten miles a day. In addition to this medicine I drank, as my common beverage with my meals, spruce beer. I had so high an opinion of this medicine in the gout, and of spruce beer as an antiscorbutic, that I contemplated with much satisfaction, and with very little doubt, the perfect restoration of my health and strength; but I was miserably deceived; for in September 1788 I was seized with the gout in a degree that none but arthritics, and indeed but few of those, can easily conceive. From this time till August 1789 I scarcely ever passed a comfortable day; seven months of this time I had been confined, my health seemed much impaired, my strength was diminished, and my appetite almost gone. In this state my friends pressed me to consult you. I was unwilling for some time to do it, as I had lost all hope of relief; however, when I had determined to apply to you, I likewise determined to give up every prejudice of my own respecting my case, and to adhere most strictly to your advice. On the 20th of August 1789 I consulted you, on the 25th I entered upon the regimen, which you prescribed, and which was as follows.

“ Drink

“ Drink no malt liquor on any account. Let your
“ beverage at dinner consist of two glasses of wine
“ diluted with three half-pints of water. .On no
“ account drink any more wine or spirituous liquors
“ in the course of the day ; but, if you want more
“ liquid, take cream and water, or milk and water,
“ or lemonade, with tea, coffee, chocolate. Use the
“ warm bath twice a week for half an hour before
“ going to bed, at the degree of heat which is most
“ grateful to your sensations. Eat meat constantly
“ at dinner, and with it any kind of tender vege-
“ tables you please. Keep the body open by two
“ evacuations daily, if possible without medicine, if
“ not take the size of a nutmeg of lenitive electuary
“ occasionally, or five grains of rhubarb every night.
“ Use no violent exercise, which may subject yourself
“ to sudden changes from heat to cold ; but as much
“ moderate exercise as may be, without being much
“ fatigued or starved with cold. Take some supper
“ every night ; a small quantity of animal food is
“ preferred ; but if your palate refuses this, take
“ vegetable food, as fruit pie, or milk ; something
“ should be eaten, as it might be injurious to you to
“ fast too long.” To the whole of this I adhered
most scrupulously, and soon found my appetite im-
prove, and with it my strength and spirits. I had
in December a severe attack, and two or three slight
ones in the course of twelve months ; but the im-
provement in the general state of my health induced
me to persevere. On the 18th of August 1790 I had

another severe attack, but it went off easier than before, and I soon recovered sufficiently to go to Buxton, which you advised me to, and from which I reaped great benefit; nevertheless on the 29th of December I had a slight attack in comparison of some that I had before experienced, and from that time I was free from gout, and enjoyed my health perfectly well till the fourth week in October 1791; from that till the third week in October 1792; from that till the third week in October 1793; and from that till June 1794. From what happened for the last three years I dreaded the month of October; but I escaped then, and have enjoyed my health most perfectly ever since till within the last week, that I have had a slight attack in one knee, which is nearly gone, without any symptom to lead me to suppose that it will go further.

“ I adhered to your advice most scrupulously for the first year; and in regard to the not drinking malt liquor, and taking only the two glasses of wine with water, I have never deviated but two days; and then the first day I only drank one glass of ale and one glass of Champagne; on the second only one glass of Champagne. With regard to the warm bath, I only use it now when I have gouty symptoms upon me, and in such situations I find it of infinite service; and in other respects I continue to live according to your direction.

“ Many persons have laughed at the idea of my perseverance in a system, which has not been able

to *cure* the gout after five years trial; but such persons are either ignorant of what I before suffered, or totally unacquainted with the nature of the disorder. Under the blessing of Providence, by an adherence to your advice, I am reaping all the benefit you flattered me I might expect from it, viz. my attacks less frequent, my sufferings less acute, and an improvement in the general state of my health.

“ I have been particular in this account of myself at your request, and am, Sir, &c.

MORLEY, near DERBY, }
February 10th, 1795. }

ROBERT WILMOT.”

There are situations nevertheless in which a paroxysm of gout has been believed to be desirable, as relieving the patient from other disagreeable diseases, or debilities, or sensations. Thus when the liver is torpid, a perpetual uneasiness and depression of spirits occur; which a fit of gout is supposed to cure by a metastasis of the disease. Others have acquired epileptic fits, probably from the disagreeable sensation of a chronically inflamed liver; which they suppose the pain and inflammation of gout would relieve. When gouty patients become much debilitated by the progress of the disease, they are liable to dropsy of the chest, which they suppose a fit of the gout would relieve. But in all these cases the attempt to procure a paroxysm of gout by wine, or aromatics, or volatiles, or blisters, or mineral waters, seldom succeeds; and the patients are obliged to apply to other methods of relief

relief adapted to their particular cases. In the two former situations small repeated doses of calomel, or mercurial uncton on the region of the liver may succeed, by giving new activity to the vessels of the liver, either to secrete or to absorb their adapted fluids, and thus to remove the cause of the gout, rather than to promote a fit of it. In the last case the tincture of digitalis, and afterwards the class of forbentia, must be applied to.

M. M. In young strong patients the gout should be cured by venesection and cathartics and diluents, with poultices externally. But it has a natural crisis by producing calcareous matter on the inflamed membrane, and therefore in old enfeebled people it is safest to wait for this crisis, attending to the natural evacuations and the degree of fever; and in young ones, where it is not attended with much fever, it is customary and popular not to bleed, but only to keep the body open with aloes, to use gentle sudorifics, as neutral salts, and to give the bark at the decline of the fit; which is particularly useful where the patient is much debilitated. See Arthritis ventriculi, Class I. 2. 4. 6. and Sect. XXV. 17.

When there is not much fever, and the patient is debilitated with age, or the continuance of the disease, a moderate opiate, as twenty drops of tincture of opium, or one grain of solid opium, may be taken every night with advantage. Externally a paste made with double the quantity of yeast is a good poultice; and booterkins made with oiled silk, as they confine the

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the perspirable matter, keep the part moist and supple, and thence relieve the pain like poultices.

The only safe way of moderating the disease is by an uniform and equal diminution, or a total abstinence from fermented liquors, with the cautions directed in Sect. XII. 7. 8. The continued use of strong bitters, as of Portland's powder, or bark, has been frequently injurious, as spoken of in the *Materia Medica*, Art. IV. 2. 11.

One of my acquaintance, who was much afflicted with the gout, abstained for about half a year from beer and wine; and not having resolution to persist, returned to his former habits of potation in less quantity; and observed that he was then for one winter stronger and freer from the gout than usual. This however did not long continue, as the disease afterwards returned with its usual or increased violence. This I think is a circumstance not unlikely to occur, as opium has a greater effect after its use has been a while intermitted; and the debility or torpor, which is the cause of gout, is thus for a few months prevented by the greater irritability of the system, acquired during the lessened use of fermented liquor.

For the same reason an ounce of spirituous tincture of guaiacum, or of bark, is said to have for some time prevented returns of the gout; which has afterwards, like all other great stimuli when long continued, been succeeded by greater debility, and destroyed the patient. This seems to have been exemplified in the case of the ingenious Dr. Brown, see Preface to his

Elementa

Elementa Medicinæ; he found temporary relief from the stimulus of wine, regardless of its future effects.

16. *Rheumatismus.* Acute rheumatism. There is reason to suspect, that rheumatic inflammations, like the gouty ones, are not a primary disease; but that they are the consequence of a translation of morbid action from one part of the system to another. This idea is countenanced by the frequent change of place of rheumatic-like gouty inflammations, and from their attacking two similar parts at the same time, as both ancles and both wrists, and these attacks being in succession to each other. Whereas it is not probable that both feet or both hands should at the same time be equally exposed to any external cause of the disease, as to cold or moisture; and less so that these should occur in succession. Lastly, from the inflammatory diathesis in this disease being more difficult to subdue, and more dangerous in event, than other common inflammations, especially to pregnant women, and in weak constitutions.

From this idea of the rheumatism being not a primary disease, like the gout, but a transferred morbid action owing to the previous torpor of some other part of the system, we perceive why it attacks weak people with greater pertinacity than strong ones; resisting or recurring again and again after frequent evacuations, in a manner very different from primary inflammations; because the cause is not removed, which is at a distance from the seat of the inflammation.

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This also accounts for rheumatic inflammations so very rarely terminating in suppuration, because like the gout the original cause is not in the inflamed part, and therefore does not continue to act after the inflammation commences. Instead of suppuration in this disease, as well as in the gout, a quantity of mucus or coagulable lymph is formed on the inflamed membrane; which in the gout changes into chalk-stones, and in the rheumatism is either reabsorbed, or lies on the membrane, producing pains on motion long after the termination of the inflammation, which pains are called chronic rheumatism. The membranes, which have thus been once or repeatedly inflamed, become less mobile, or less liable to be affected by sympathy, as appears by the gout affecting new parts, when the joints of the foot have been frequently inflamed by it; hence as the cause of the inflammation does not exist in the inflamed part, and as this part becomes less liable to future attacks, it seldom suppurates.

Secondly, when rheumatism affects the muscles of the chest, it produces symptoms similar to pleurisy, but are distinguished from that by the patient having previously suffered rheumatic affections in other parts, and by the pertinacity or continuance of the inflammatory state of the patient, this should be termed pleurodynæ rheumatica.

Thirdly, when rheumatic inflammation affects the bowels, it produces a disease very different from enteritis, or common inflammation of the bowels, and should

should be termed enteralgia rheumatica. The pain is less than in enteritis, and the disease of longer continuance, with harder pulse, and the blood equally fizy. It is attended with frequent dejections, with much mucus, and previous griping pains, but without vomiting; and differs perhaps from dysentery from its not being attended with bloody stools, and not being infectious.

Fourthly, there is another kind of rheumatism attended with debility, which suppurates, and should be termed rheumatismus suppurans. It is generally believed to be the gout, till suppuration takes place on the swelled joint; and, as the patient sinks, there are sloughs formed over the whole mouth; and he seems to be destroyed by inflammation or gangrene of the mucous membranes. I have twice seen this disease in patients about sixty. Some other diseases are erroneously called rheumatic, as hemicrania, and odontalgia. See Sect. XXVI. 3.

M. M. In the three former kinds venesection repeatedly. Cathartics. Antimonials. Diluents. Neutral salts. Oil. Warm bath. Afterwards the bark. Opium with or without ipecacuanha; but not till the patient is considerably weakened. Sweats forced early in the disease do injury. Opium given early in the disease prolongs it. In the last kind, gentle stimulants, as wine and water, mucilage, forbentia.

The following is a case of suppurative rheumatism. Mr. F——, about sixty, was supposed to have the gout in his hand, which however suppurated, and it

was then called the suppurative rheumatism. He had lived rather intemperately in respect to wine, and was now afflicted with a tendency to inflammation of the mucous membranes. As he lay on the bed half supine, propped up with pillows, and also slept in that posture, his lower jaw dropped by its own weight, when the voluntary power of the muscles was suspended. The mucus of his mouth and throat became quite dry, and at length was succeeded with sloughs; this was a most distressing circumstance to him, and was in vain endeavoured to be relieved by supporting his jaw by slender steel springs fixed to his night-cap, and by springs of elastic gum. The sloughs spread and seemed to accelerate his death. See Class I. 1. 3. 2.

17. *Erysipelas*. The erysipelas differs from the zona ignea, and other species of herpes, in its being attended with fever, which is sometimes of the sensitive irritated or inflammatory kind, with strong and full pulse; and at other times with weak pulse and great inirritability, as when it precedes or attends mortifications. See Class II. 1. 3. 2.

Like the zona ignea above described, it seems to be a secondary disease, having for its primary part the torpor or inflammation of some internal or distant membrane, as appears from its so frequently attending wounds; sometimes spreading from issues over the whole limb, or back, by sympathy with a tendon or membrane, which is stimulated by the pease in them.

In its more violent degree I suppose that it sympathizes with some extensive internal membranes, as of the liver, stomach, or brain. Another reason, which countenances this idea, is, that the inflammation gradually changes its situation, one part healing as another inflames; as happens in respect to more distant parts in gout and rheumatism; and which seems to shew, that the cause of the disease is not in the same place with the inflammation. And thirdly, because the erysipelas of the face and head is liable to affect the membranes of the brain; which were probably in these cases the original or primary seat of the disease; and lastly, because the fits of erysipelas, like those of the gout, are liable to return at certain annual or monthly periods, as further treated of in Class II. 1. 3. 2.

Many cases of erysipelas from wounds or bruises are related in Default's Surgical Journal, Vol. II. in which poultices are said to do great injury, as well as oily or fatty applications. Saturnine solutions were sometimes used with advantage. A grain of emetic tartar given to clear the stomach and bowels, is said to be of great service.

18. *Testium tumor in gonorrhœa.* Mr. Hunter in his Treatise on the Venereal Disease observes, that the tumor of the testes in gonorrhœa arises from their sympathy with the inflammation of the urethra; and that they are not similar to the actions arising from the application of venereal matter, whether by absorption

forption or otherwise; as they seldom or never suppurate; and when suppuration happens, the matter produced is not venereal. Treatise on Venereal Disease, p. 53.

19. *Testium tumor in parotidite.* The sympathy between some parts about the throat and the genitals has been treated of in Class IV. 1. 2. 7. The swelling of the testes, when that of the parotis subsides, seems to arise from the association of successive action; as the tension of the penis in hydrophobia appears to arise from the previous synchronous associations of the sensitive motions of these parts; but the manner of the production of both these associations is yet very obscure. In women a swelling of the breasts often succeeds the decline of the mumps by another wonderful sympathy. See Class IV. 1. 2. 7. and I. 1. 2. 15. In many persons a delirium succeeds the swelling of the parotis, or the subsequent ones of the testes or breasts; which is sometimes fatal, and seems to arise from a sympathy of successive action, and not of synchronous action, of the membranes of the brain with those of the parotid glands. Sometimes a stupor comes on instead of this delirium, which is relieved by fomenting the shaved head for an hour or two, See Class II. 1. 3. 4.

ORDO I.

Increased Associate Motions.

GENUS III.

Catenated with Voluntary Motions.

SPECIES.

1. *Deglutitio invita.* When any one is told not to swallow his saliva, and that especially if his throat be a little sore, he finds a necessity of immediately swallowing it; and this the more certainly, the more he voluntarily endeavours not to do so.

In this case the voluntary power exerted by our attention to the pharynx renders it more sensible to irritation, and therefore occasions it to be more frequently induced to swallow the saliva. Here the irritation induces a volition to swallow it, which is more powerful than the desire not to swallow it. See XXIV. 1. 7. So in reverie, when the voluntary power was exerted on any of the senses, as of sight or taste, the objects of those senses became perceived; but not otherwise. Sect. XIX. 6. This is a troublesome symptom in some sore throats.

M. M. Mucilage, as sugar and gum arabic. Warm water held in the mouth frequently, as a fomentation to the inflamed throat.

2. *Nictitatio invita.* Involuntary winking with the eye-lids, and twitchings of the face, are originally induced by an endeavour to relieve some disagreeable

able sensations about inflamed eyes, as the dazzling of light; and afterwards these motions become catenated with other motions or sensations, so as not to be governed by the will. Here the irritation first produces a volition to wink, which by habit becomes stronger than the anti-volition not to wink.

This subject is rendered difficult from the common acceptation of the word, volition, including previous deliberation, as well as the voluntary exertion, which succeeds it. In the volitions here spoken of there is no time for deliberation or choice of objects, but the voluntary act immediately succeeds the sensation which excites it.

M. M. Cover the affected parts with a sticking plaster or a blister. Pass a fine needle and thread through a part of the skin over the muscle, which moves, and attach the other end of the thread by a sticking plaster to a distant part. An issue behind the ear. To practice daily by a looking-glass to stop the motions with the hand. See the cure of a case of the leaping of a muscle of the arm, Sect. XVII. 1. 8. See Convulsio debilis, Class III. 1. 1. 5.

3. *Risus involuntus*. Involuntary laughter. When the pleasure arising from new combinations of words and ideas, as in puns; or of other circumstances, which are so trivial, as to induce no voluntary exertion to compare or consider their present importance or their future consequence; the pleasure is liable to rise into pain; that is, the ideas or sensual motions become exerted too violently for want of some anti-

thesistic ideas; in the same manner as those muscles, which have weak antagonists, as those of the calf of the leg, are liable to fall into cramp or painful contraction. In this situation a scream is begun to relieve this pain of ideas too violently exerted, which is stopped again soon, as explained in Sect. XXXIV. 1. 4. and Class III. 1. 1. 4. and IV. 2. 3. 3.

The pain, into which this pleasure rises, which would excite the scream of laughter, has been felt forcibly by every one; when they have been under such circumstances, as have induced them to restrain it by a counter-volition; till at length the increased associate motions produce so much pain as to overcome the counter-volition, and the patient bursts out into indecent laughter, contrary to his will in the common acceptance of that word.

4. *Lusus digitorum involitus*. An awkward playing with the fingers in speaking in public. These habits are begun through bashfulness, and seem rather at first designed to engage the attention in part, and thus prevent the disagreeable ideas of mauvaise hont; as timorous boys whistle, when they are obliged to walk in the dark; and as it is sometimes necessary to employ raw soldiers in perpetual manœuvres, as they advance to the first charge.

5. *Unguium morsuncula invita*. Biting the nails is a depraved habit arising from similar causes as those of the last article.

M. M. Dip the fingers in solution of aloes.

6. *Vigilia*

6. *Vigilia invita*. Watchfulness, where the person wishes, and endeavours to fall asleep, properly belongs to this place, as the wish or volition to sleep prevents the desired effect; because sleep consists in an abolition of volition. See Class III. 1. 2. 3.

O R D O. I.

Increased Associate Motions.

G E N U S. IV.

Catenated with External Influences.

S P E C I E S.

1. *Vita ovi*. Life of an egg. The eggs of fowls were shewn by Mr. J. Hunter to resist the freezing process in their living state more powerfully, than when they were killed by having the yolk and white shook together. *Philos. Transf.* It may be asked, does the heat during the incubation of eggs act as a stimulus exciting the living principle into activity? Or does it act simply as a *causa sine quâ non*, as an influence, which penetrating the mass, removes the particles of it to a greater distance from each other, so as to allow their movement over each other, in the same manner as heat is conceived to produce the fluidity of water; not by stimulus, but by its penetrating influence? Or may elementary heat in its uncombined state be supposed to act only as an influence necessary

to life in its natural quantity ; whence torpor and death follow the education of it from the body ; but in its increased state above what is natural, or usual, that it acts as a stimulus ; which we have a sense to perceive ; and which excites many parts of the system into unnatural action ? See Class IV. 1. 1. C.

2. *Vita hiemi-dormientium.* The torpor of insects, and birds, and quadrupeds, during the cold season, has been called sleep ; but I suppose it must differ very much from that state of animal life, since not only all voluntary power is suspended, but sensation and vascular motion has ceased, and can only be restored by the influence of heat. There have been related instances of snails, which have recovered life and motion on being put into water after having experienced many years of torpidity, or apparent death, in the cabinets of the curious. Here the water as well as the heat are required not only as a stimulus, but as a *causa sine qua non* of fluidity and motion, and consequent life.

3. *Pullulatio arborum.* The annual revivescence of the buds of trees seems not only to be owing to the influence of the returning warmth of the spring, but also to be catenated with solar gravitation ; because seeds and roots and buds, which are analogous to the eggs of animals, put forth their shoots by a less quantity of heat in spring, than they had undergone in the latter part of autumn, which may however be ascribed

cribed to their previous torpid state, and consequent accumulation of sensorial power, or irritability; as explained in Botanic Garden, Part II. Cant. I. l. 322. note. Other circumstances, which countenance the idea, that vegetation is affected by solar gravitation, as well as by heat, may be observed in the ripening of the seeds of plants both in those countries where the summers are short, and in those where they are long. And by some flowers closing their bells at noon, or soon after; and hence seem to sleep rather at solar diurnal periods, than from the influence of cold, or the deficiency of light.

4. *Orgasmatis veneræi periodus.* The venereal orgasm of birds and quadrupeds commences or returns about the vernal or autumnal equinoxes, and thence seems in respect to their great periods to be governed by solar influence. But if this orgasm be disappointed of its object, it is said to recur at about monthly periods, as observed in mares and bitches in this respect resembling the female catamenia. See Sect. XXXVI. 2. 3. and Sect. XVI. 13.

5. *Brachii concussio electrica.* The movement of the arm, even of a paralytic patient, when an electric shock is passed through it, is owing to the stimulus of the excess of electricity. When a piece of zinc and silver, each about the size of a crown-piece, are placed one under the upper lip, and the other on the tongue, so as the outer edges may be brought into

contact, there is an appearance of light in the eyes, as often as the outer edges of these metals are brought into contact or separated; which is another instance of the stimulus of the passage of electric shocks through the fibres of the organs of sense, as well as through the muscular fibres. See Sect. XII. I. 1. and first addit. note to Vol. I. of this work. But in its natural state electricity seems only to act as an influence on animal and vegetable bodies; of the salutary or injurious effects of which we have yet no precise knowledge.

Yet if regular journals were kept of the variations of atmospheric electricity, it is probable some discoveries of its influence on our system might in time be discovered. For this purpose a machine on the principle of Mr. Bennet's electric doubler might be applied to the pendulum of a clock, so as to manifest, and even to record the daily or hourly variations of aerial electricity. Which has already been executed, and applied to the pendulum of a Dutch wooden clock, by Mr. Bennet, curate of Wirksworth in Derbyshire.

Besides the variations of the degree or kind of atmospheric electricity, some animals, and some men, seem to possess a greater power of accumulating this fluid in themselves than others. Of which a famous history of a Russian prince was lately published; who, during the clear and severe frosts of that country, could not move himself in bed without luminous coruscations. Such may have been the case of those people, who have been related to have taken fire spontaneously,

taneously, and to have been reduced to ashes. The electric concussion from the gymnotus electricus, and torpedo, are other instances of the power of the animal system to accumulate electricity, as in these it is used as a weapon of defence, or for the purpose of taking their prey.

Some have believed that the accumulation or passage of the magnetic fluid might affect the animal system, and have asserted that the application of a large magnet to an aching tooth has quickly effected a cure. If this experiment is again tried in odontalgia, or hemi-crania, the painful membrane of the tooth or head should be included between the south and north poles of a horse-shoe magnet, or between the contrary poles of two different magnets, that the magnetism may be accumulated on the torpid part.

6. *Oxygenatio sanguinis.* The variation of the quantity of oxygen gas existing in the atmosphere must affect all breathing animals; in its excess this too must be esteemed a stimulus; but in its natural quantity would seem to act as an influence, or cause, without which animal life cannot exist even a minute. It is hoped that Dr. Beddoes's plan for a pneumatic infirmary, for the purpose of putting this and various other airs to the test of experiment, will meet with public encouragement, and render consumption, asthma, cancer, and many diseases conquerable, which at present prey with unremitting devastation on all orders and ages of mankind.

7. *Humectatio*

7. *Humectatio corporis.* Water, and probably the vapour of water dissolved or diffused in the atmosphere, unites by mechanical attraction with the unorganized cuticle, and softens and enlarges it; as may be seen in the loose and wrinkled skin of the hands of washerwomen; the same probably occurs to the mucous membrane of the lungs in moist weather; and by thickening it increases the difficulty of respiration of some people; who are said to be asthmatical. So far water may be said to act as an influx or influence, but when it is taken up by the mouths of the absorbent system, it must excite those mouths into action, and then acts as a stimulus.

There appears from hence to be four methods by which animal bodies are penetrated by external things. 1. By their stimulus, which induces the absorbent vessels to imbibe them. 2. By mechanical attraction, as when water softens the cuticle. 3. By chemical attraction, as when oxygen passes through the membranes of the air-vessels of the lungs, and combines with the blood. And lastly, by influx without mechanical attraction, chemical combination, or animal absorption, as the universal fluids of heat, gravitation, electricity, magnetism, and perhaps of other ethereal fluids yet unknown.

ORDO II.

Decreased Associate Motions.

GENUS I.

Catenated with Irritative Motions.

As irritative muscular motions are attended with pain, when they are exerted too weakly, as well as when they are exerted too strongly; so irritative ideas become attended with sensation, when they are exerted too weakly, as well as when they are exerted too strongly. Which accounts for these ideas being attended with sensation in the various kinds of vertigo described below.

There is great difficulty in tracing the immediate cause of the deficiencies of action of some links of the associations of irritative motions; first, because the trains and tribes of motions, which compose these links, are so widely extended as to embrace almost the whole animal system; and secondly, because when the first link of an associated train of actions is exerted with too great energy, the second link by reverse sympathy may be affected with torpor. And then this second link may transmit, as it were, this torpor to a third link, and at the same time regain its own energy of action; and it is possible this third link may in like manner transmit its torpor to a fourth, and thus regain its own natural quantity of motion.

I shall endeavour to explain this by an example taken from sensitive associated motions, as the origin
of

of their disturbed actions is more easily detected. This morning I saw an elderly person, who had gradually lost all the teeth in his upper jaw, and all of the under except three of the molares; the last of these was now loose, and occasionally painful; the fangs of which were almost naked, the gums being much wasted both within and without the jaw. He is a man of attentive observation, and assured me, that he had again and again noticed, that, when a pain commenced in the membranes of the alveolar process of the upper jaw opposite to the loose tooth in the under one (which had frequently occurred for several days past), the pain of the loose tooth ceased. And that, when the pain afterwards extended to the ear and temple on that side, the pain in the membranes of the upper jaw ceased. In this case the membranes of the alveolar process of the upper jaw became torpid, and consequently painful, by their reverse sympathy with the too violent actions of the inflamed membranes of the loose tooth; and then by a secondary sympathy the membranes about the ear and temple became torpid, and painful; and those of the alveolar process of the upper jaw regained their natural quantity of action, and ceased to be painful. A great many more nice and attentive observations are wanted to elucidate these curious circumstances of association, which will be found to be of the greatest importance in the cure of many diseases, and lead us to the knowledge of fever.

SPECIES.

SPECIES.

1. *Cutis frigida pransorum.* Chillness after dinner frequently attends weak people, or those who have been exhausted by exercise; it arises from the great expenditure of the sensorial power on the organs of digestion, which are stimulated into violent action by the aliment; and the vessels of the skin, which are associated with them, become in some measure torpid by reverse sympathy; and a consequent chillness succeeds with less absorption of atmospheric moisture. See the subsequent article.

2. *Pallor urinæ pransorum.* The paleness of urine after a full meal is an instance of reverse association; where the secondary part of a train of associate motions acts with less energy in consequence of the greater exertions of the primary part. After dinner the absorbent vessels of the stomach and intestines are stimulated into greater action, and drink up the newly taken aliment; while those, which are spread in great number on the neck of the bladder, absorb less of the aqueous part of the urine than usual, which is therefore discharged in a more dilute state; and has been termed crude by some medical writers, but it only indicates, that so great a proportion of the sensorial power is expended on digestion and absorption of the aliment, that other parts of the system act for a time with less energy. See Class IV. 1. 1. 6.

3. *Pallor*

3. *Pallor urinæ a frigore cutaneo.* There is a temporary discharge of pale water, and a diarrhœa, induced by exposing the skin to the cold air; as is experienced by boys, who strip themselves before bathing. In this case the mouths of the cutaneous lymphatics become torpid by the subduction of their accustomed degree of heat, and those of the bladder and intestines become torpid by direct sympathy; whence less of the thinner part of the urinary secretion, and of the mucus of the intestines, is reabsorbed. See Sect. XXIX. 4. 6. This effect of suddenly cooling the skin by the aspersions of cold water has been used with success in costiveness, and has produced evacuations, when other means have failed. When young infants are afflicted with griping joined with costiveness, I have sometimes directed them to be taken out of a warm bed, and carried about for a few minutes in a cool room, with almost instant relief.

4. *Pallor ex ægritudine.* When sickness of stomach first occurs, a paleness of the skin attends it; which is owing to the association or catenation between the capillaries of the stomach and the cutaneous ones; which at first act by direct sympathy. But in a short time there commences an accumulation of the sensorial power of association in the cutaneous capillaries during their state of inactivity, and then the skin begins to glow, and sweats break out, from the increased action of the cutaneous glands or capillaries, which is now in
reverse

reverse sympathy with those of the stomach. So in continued fevers, when the stomach is totally torpid, which is known by the total aversion to solid food, the cutaneous capillaries are by reverse sympathy in a perpetual state of increased activity, as appears from the heat of the skin.

5. *Dyspnœa a balneo frigido.* The difficulty of breathing on going up to the middle in cold water is owing to the irritative association or catenation of the action of the extreme vessels of the lungs with those of the skin. So that when the latter are rendered torpid or inactive by the application of sudden cold, the former become inactive at the same time, and retard the circulation of the blood through the lungs, for this difficulty of breathing cannot be owing to the pressure of the water impeding the circulation downwards, as it happens equally by a cold shower-bath, and is soon conquered by habitual immersions. The capillaries of the skin are rendered torpid by the subduction of the stimulus of heat, and by the consequent diminution of the sensorial power of irritation. The capillaries of the lungs are rendered torpid by the diminution of the sensorial power of association, which is now excited in less quantity by the lessened actions of the capillaries of the skin, with which they are catenated. So that at this time both the cutaneous and pulmonary capillaries are principally actuated, as far as they have any action, by the stimulus of the blood. But in a short time the sensorial powers of irritation, and of association, become accumulated, and very energetic

energetic action of both these membranes succeed, which thus resemble the cold and hot fit of an intermittent fever.

6. *Dyspepsia a pedibus frigidis.* When the feet are long cold, as in riding in cold and wet weather, some people are very liable to indigestion and consequent heart-burn. The irritative motions of the stomach become torpid, and do their office of digestion imperfectly, in consequence of their association with the torpid motions of the vessels of the extremities. Fear, as it produces paleness and torpidity of the skin, frequently occasions temporary indigestion in consequence of this association of the vessels of the skin with those of the stomach; as riding in very bad roads will give flatulency and indigestion to timorous people.

A short exposure to cold air increases digestion, which is then owing to the reverse sympathy between the capillary vessels of the skin, and of the stomach. Hence when the body is exposed to cold air, within certain limits of time and quantity of cold, a reverse sympathy of the stomach and the skin first occurs, and afterwards a direct sympathy. In the former case the expenditure of sensorial power by the skin being lessened, but not its production in the brain; the second link of the association, viz. the stomach, acquires a greater share of it. In the latter case, by the continuation of the deficient stimulus of heat, the torpor becomes extended to the brain itself, or to the trunks of the nerves; and universal inactivity follows.

7. *Tuffis a pedibus frigidis* On standing with the feet in thawing snow, many people are liable to incessant coughing. From the torpidity of the absorbent vessels of the lungs, in consequence of their irritative associations with those of the skin, they cease to absorb the saline part of the secreted mucus; and a cough is thus induced by the irritation of this saline secretion; which is similar to that from the nostrils in frosty weather, but differs in respect to its immediate cause; the former being from association with a distant part, and the latter from defect of the stimulus of heat on the nostrils themselves. See *Catarrhus frigidus*, Class I. 2. 3. 3.

8. *Tuffis hepatica*. The cough of inebriates, which attends the enlargement of the liver, or a chronical inflammation of its upper membrane, is supposed to be produced by the inconvenience the diaphragm suffers from the compression or heat of the liver. It differs however essentially from that attending hepatitis, from its not being accompanied with fever. And is perhaps rather owing to irritative association, or reverse sympathy, between the lungs and the liver. As occurs in sheep, which are liable to a perpetual dry cough, when the fleuk-worm is preying on the substance of their livers. See Class II. 1. 1. 5.

M. M. From half a grain to a grain of opium twice a day. A drachm of mercurial ointment rubbed on the region of the liver every night for eight or ten times.

9. *Tussis arthritica*. Gout-cough. I have seen a cough, which twice occurred at a few years distance in the same person, during his fits of the gout, with such pertinacity and violence as to resist venesection, opiates, bark, blisters, mucilages, and all the usual methods employed in coughs. It was for a time supposed to be the whooping-cough, from the violence of the action of coughing; it continued two or three weeks, the patient never being able to sleep more than a few minutes at once during the whole time, and being propped up in bed with pillows night and day.

As no fever attended this violent cough, and but little expectoration, and that of a thin and frothy kind, I suspected the membrane of the lungs to be rather torpid than inflamed, and that the saline part of the mucus not being absorbed stimulated them into perpetual exertion. And lastly, that though the lungs are not sensible to cold and heat, and probably therefore less mobile; yet, as they are nevertheless liable to consent with the torpor of cold feet, as described in Species 6 of this Genus, I suspected this torpor of the lungs to succeed the gout in the feet, or to act a vicarious part for them.

10. *Vertigo rotatoria*. In the vertigo from circumgyration the irritative motions of vision are increased; which is evinced from the pleasure that children receive on being rocked in a cradle, or by swinging on a rope. For whenever sensation arises from the production

duction of irritative motion with less energy than natural, it is of the disagreeable kind, as from cold or hunger; but when it arises from their production with greater energy than natural, if it be confined within certain limits, it is of the pleasurable kind, as by warmth or wine. With these increased irritative motions of vision, I suppose those of the stomach are performed with greater energy by direct sympathy; but when the rotatory motions, which produce this agreeable vertigo, are continued too long, or are too violent, sickness of the stomach follows; which is owing to the decreased action of that organ from its reverse sympathy with the increased actions of the organ of vision. For the expenditure of sensorial power by the organ of vision is always very great, as appears by the size of the optic nerves; and is now so much increased as to deprive the next link of association of its due share. As mentioned in Article 6 of this Genus.

In the same manner the undulations of water, or the motions of a ship, at first give pleasure by increasing the irritative motions belonging to the sense of vision; but produce sickness at length by expending on one part of the associated train of irritative actions too much of that sensorial power, which usually served the whole of it; whence some other parts of the train acquire too little of it, and perform their actions in consequence too feebly, and thence become attended with disagreeable sensation.

It must also be observed, that when the irritative motions are stimulated into unusual action, as in in-

ebriation, they become succeeded by sensation, either of the pleasurable or painful kind; and thus a new link is introduced between the irritative motions thus excited, and those which used to succeed them; whence their association is either dissolved or much weakened, and thus the vomiting in sea-sickness occurs from the defect of the power of association, rather than from the general deficiency of sensorial power.

When a blind man turns round, or when one, who is not blind, revolves in the dark, a vertigo is produced belonging to the sense of touch. A blind man balances himself by the sense of touch, which being a less perfect means of determining small quantities of deviation from the perpendicular, occasions him to walk more carefully upright than those, who balance themselves by vision. When he revolves, the irritative associations of the muscular motions, which were used to preserve his perpendicularity, become disordered by their new modes of successive exertion; and he begins to fall. For his feet now touch the floor in manners or directions different from those they have been accustomed to; and in consequence he judges less perfectly of the situation of the parts of the floor in respect to that of his own body, and thus loses his perpendicular attitude. This may be illustrated by the curious experiment of crossing one finger over the next to it, and feeling of a nut or bullet with the ends of them. When, if the eyes be closed, the nut or bullet appears to be two, from the deception of the sense of touch.

In this vertigo from gyration, both of the sense of sight, and of the sense of touch, the primary link of the associated irritative motions is increased in energy, and the secondary ones are increased at first by direct sympathy; but after a time they become decreased by reverse sympathy with the primary link, owing to the exhaustion of sensorial power in general, or to the power of association in particular; because in the last case, either pleasurable or painful sensation has been introduced between the links of a train of irritative motions, and has dissevered, or much enfeebled them.

Dr. Smyth, in his Essay on Swinging in Pulmonary Consumption, has observed, that swinging makes the pulse slower. Dr. Ewart of Bath confirmed this observation both on himself and on Col. Cathcart, who was then hectic, and that even on shipboard, where some degree of vertigo might be supposed previously to exist. Dr. Currie of Liverpool not only confirmed this observation frequently on himself, when he was also phthical, but found that equitation had a similar effect on him, uniformly retarding his pulse. This curious circumstance cannot arise from the general effect of exercise, or fatigue, as in those cases the pulse becomes weaker and quicker; it must therefore be ascribed to a degree of vertigo, which attends all those modes of motion, which we are not perpetually accustomed to.

Dr. Currie has further observed, that "in cases of great debility the voluntary muscular exertion requisite in a swing produces weariness, that is, increases

debility; and that in such instances he had frequently noticed, that the diminution of the frequency of the pulse did not take place, but the contrary." These circumstances may thus be accounted for.

The links of association, which are effected in the vertigo occasioned by unusual motion, are the irritative motions of the sense of vision, those of the stomach, and those of the heart and arteries. When the irritative ideas of vision are exerted with greater energy at the beginning of vertigo, a degree of sensation is excited, which is of the pleasurable kind, as above mentioned; whence the associated trains of irritative motions of the stomach, and heart, and arteries, act at first with greater energy, both by direct sympathy, and by the additional sensorial power of sensation. Whence the pulse of a consumptive patient becomes stronger and consequently slower.

But if this vertigo becomes much greater in degree or duration, the first link of this train of associated irritative motions expends too much of the sensorial power, which was usually employed on the whole train; and the motions of the stomach become in consequence exerted with less energy. This appears, because in this degree of vertigo sickness supervenes, as in sea-sickness, which has been shewn to be owing to less energetic action of the stomach. And the motions of the heart and arteries then become weaker, and in consequence more frequent, by their direct sympathy with the lessened actions of the stomach. See Supplement, I. 12. and Class II. 1. 6. 7. The general weakness

weakness from fatigue is owing to a similar cause, that is, to the too great expenditure of sensorial power in the increased actions of one part of the system, and the consequent deficiency of it in other parts, or in the whole.

The abatement of the heat of the skin in hectic fever by swinging, is not only owing to the increased ventilation of cool air, but to the reverse sympathy of the motions of the cutaneous capillaries with those of the heart and arteries; which occurs in all fevers with arterial debility, and a hot or dry skin. Hence during moderate swinging the action of the heart and arteries becomes stronger and slower, and the action of the capillaries, which was before too great, as appeared by the heat of the skin, now is lessened by their reverse sympathy with that of the heart and arteries. See Supplement, I. 8.

II. *Vertigo visualis*. Visual vertigo. The vertigo rotatoria described above, was induced by the rotation or undulation of external objects, and was attended with increased action of the primary link of the associated motions belonging to vision, and with consequent pleasure. The vertigo visualis is owing to less perfect vision, and is not accompanied with pleasurable sensation. This frequently occurs in strokes of the palsy, and is then succeeded by vomiting; it sometimes precedes epileptic fits, and often attends those, whose sight begins to be impaired by age.

In this vertigo the irritative ideas of the apparent motions of objects are less distinct, and on that account are not succeeded by their usual irritative associations of motion; but excite our attention. Whence the objects appear to librate or circulate according to the motions of our heads, which is called dizziness; and we lose the means of balancing ourselves, or preserving our perpendicularity, by vision. So that in this vertigo the motions of the associated organs are decreased by direct sympathy with their primary link of irritation; as in the preceding case of sea-sickness they are decreased by reverse sympathy.

When vertigo affects people about fifty years of age, their sight has generally been suddenly impaired; and from their less accurate vision they do not soon enough perceive the apparent motions of objects; like a person in a room, the walls of which are stained with the uniform figures of lozenges, explained in Sect. XX. 1. This is generally ascribed to indigestion; but it ceases spontaneously, as the patient acquires the habit of balancing himself by less distinct objects.

A gentleman about 50 was seized with an uncommon degree of vertigo, so as to fall on the ground, and not to be able to turn his head, as he sat up either in his chair or in his bed, and this continued eight or ten weeks. As he had many decayed teeth in his mouth, and the vertigo was preceded and sometimes accompanied by pains on one side of his head, the disease of a tooth was suspected to be the cause.

And

And as his timidity was too great to admit the extraction of those which were decayed; after the trial of cupping repeatedly, fomentations on his head, repeated blisters with, valerian, Peruvian bark, musk, opium, and variety of other medicines; mercurials were used, both externally and internally, with design to inflame the membranes of the teeth, and by that means to prevent the torpor of the action of the membranes about the temple, and parietal bone; which are catenated with the membranes of the teeth by irritative association, but not by sensitive association. The event was, that as soon as the gums became sore with a slight ptyalism, the pains about the head and vertigo gradually diminished, and during the soreness of his gums entirely ceased; but I believe recurred afterwards, though in less degree.

The idea of inflaming the membranes of the teeth to produce increased sensation in them, and thus to prevent their irritative connection with those of the cranium, was taken from the treatment of trismus, or locked jaw, by endeavouring to inflame the injured tendon; which is said to prevent or to remove the spasm of the muscles of the jaw. See Class III. 1. 1. 13. and 15.

M. M. Emetics. Blisters. Issues about the head. Extraction of decayed teeth. Slight salivation. Sorbentia. Incitantia.

12. *Vertigo ebriosa*. Vertigo from intoxication is owing to the association of the irritative ideas of vision with the irritative motions of the stomach. Whence
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when these latter become much increased by the immoderate stimulus of wine, the irritative motions of the retina are produced with less energy by reverse sympathy, and become at the same time succeeded by sensation in consequence of their decreased action. See Sect. XXI. 3. and XXXV. 1. 2. So conversely when the irritative motions of vision are increased by turning round, or by our unaccustomed agitation at sea, those of the stomach become inverted by reverse sympathy, and are attended in consequence with disagreeable sensation. Which decreased action of the stomach is in consequence of the increased expenditure of the sensorial power on the irritative ideas of vision, as explained in *Vertigo rotatoria*.

Whence though a certain quantity of vinous spirit stimulates the whole system into increased action, and perhaps even increases the secretion of sensorial power in the brain; yet as soon as any degree of vertigo is produced, it is a proof, that by the too great expenditure of sensorial power by the stomach, and its nearest associated motions, the more distant ones, as those of vision, become imperfectly exerted. From hence may be deduced the necessity of exhibiting wine in fevers with weak pulse in only appropriated quantity; because if the least intoxication be induced, some part of the system must act more feebly from the unnecessary expenditure of sensorial power.

13. *Vertigo febriculosa*. Vertigo in fevers either proceeds from the general deficiency of sensorial power belonging to the irritative associations, or to a greater expenditure

expenditure of it on some links of the trains and tribes of associated irritative motions. There is however a slighter vertigo attending all people, who have been long confined in bed, on their first rising; owing to their having been so long unused to the apparent motions of objects in their erect posture, or as they pass by them, that they have lost in part the habit of balancing themselves by them.

14. *Vertigo cerebrosa.* Vertigo from injuries of the brain, either from external violence, or which attend paralytic attacks, are owing to the general deficiency of sensorial power. In these distressful situations the vital motions, or those immediately necessary to life, claim their share of sensorial power in the first place, otherwise the patient must die; and those motions, which are less necessary, feel a deficiency of it, as these of the organs of sense and muscles; which constitute vertigo; and lastly the voluntary motions, which are still less immediately necessary to life, are frequently partially destroyed, as in palsy; or totally, as in apoplexy.

15. *Murmur aurium vertiginosum.* The vertiginous murmur in the ears, or noise in the head, is compared to the undulations of the sound of bells, or to the humming of bees. It frequently attends people about 60 years of age; and like the visual vertigo described above is owing to our hearing less perfectly from the gradual inirritability of the organ on the approach of
age;

age; and the disagreeable sensation of noise attending it is owing to the less energetic action of these irritative motions; which not being sufficiently distinct to excite their usual associations become succeeded by our attention, like the indistinct view of the apparent motions of objects mentioned in vertigo visualis. This may be better understood from considering the use, which blind men make of these irritative sounds, which they have taught themselves to attend to, but which escape the notice of others. The late blind Justice Fielding walked for the first time into my room, when he once visited me, and after speaking a few words said, "this room is about 22 feet long, 18 wide, and 12 high;" all which he guessed by the ear with great accuracy. Now if these irritative sounds from the partial loss of hearing do not correspond with the size or usual echoes of the places, where we are; their catenation with other irritative ideas, as those of vision, becomes disordered or disturbed; and we attend to them in consequence, which I think unravels this intricate circumstance of noises being always heard in the head, when the sense of hearing begins to be impaired, from whatever cause it occurs.

This ringing in the ears also attends the vertigo from intoxication; for the irritative ideas of sound are then more weakly excited in consequence of the deficiency of the sensorial power of association. As is known by this also being attended with disagreeable sensation, and by its accompanying other diseases of debility, as strokes on the head, fainting fits, and
paralytic

paralytic feizures. For in this vertigo from intoxication fo much fenforial power in general is expended on the increased actions of the ftomach, and its nearest connections, as the capillaries of the fkin; that there is a deficiency for the purpofes of the other irritative affociations of motions ufually connected with it. This auditory vertigo attends both the rotatory and the vifual vertigo above mentioned; in the former it is introduced by reverse fymathy, that is, by the diminution of fenforial power; too great a quantity of it being expended on the increased irritative motions of vifion; in the latter it is produced either by the fame caufes which produce the vifual vertigo, or by direct fymathy with it. See Sect. XX. 7.

M. M. Stimulate the internal ear by ether, or with effential oil diluted with expreffed oil, or with a folution of opium in wine, or in water. Or with falt and water.

16. *Tactus, gustus, olfactus vertiginofi.* Vertiginous touch, tafte, and fmell. In the vertigo of intoxication, when the patient lies down in bed, it fometimes happens even in the dark, that the bed feems to librate under him, and he is afraid of falling out of it. The fame occurs to people, who are fea-fick, even when they lie down in the dark. In thefe the irritative motions of the nerves of touch, or irritative tangible ideas, are performed with lefs energy, in one cafe by reverse fymathy with the ftomach, in
the

the other by reverse sympathy with the nerves of vision, and in consequence become attended with sensation, and produce the fear of falling by other associations.

A vertigo of the sense of touch may be produced, if any one turns round for a time with his eyes shut, and suddenly stops without opening them; for he will for a time seem to be still going forwards; which is difficult to explain. See the notes at the end of the First and Second Part belonging to Sect. XX. 6.

In the beginning of some fevers, along with incessant vomiting, the patients complain of disagreeable tastes in their mouth, and disagreeable odours; which are to be ascribed to the general debility of the great veins and tribes of associated irritative motions, and to be explained from their direct sympathy with the decreased action of a sick stomach; or from the less secretion of sensorial power in the brain. These organs of sense are constantly stimulated into action by the saliva or by the air; hence, like the sense of hunger, when they are torpid from want of stimulus, or from want of sensorial power, pain or disagreeable sensation ensues, as of hunger, or faintness, or sickness in one case; and the ideas of bad tastes or odours in the other. This accords with the laws of causation, Sect. IV. 5.

17. *Pulsus mollis in vomitione.* The softness of the pulse in the act of vomiting is caused by direct association between the heart and the stomach; as explained
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in Sect. XXV. 17. A great slowness of the pulsation of the heart sometimes attends sickness, and even with intermissions of it, as in the exhibition of too great a dose of digitalis.

18. *Pulsus intermittens a ventriculo.* When the pulse first begins to intermit, it is common for the patient to bring up a little air from his stomach; which if he accomplishes before the intermission occurs, always prevents it; whence that this debility of the heart is owing to the direct association of its motions with those of the stomach is well evinced. See Sect. XXV. 17.

I this morning saw Mr. —, who has long had at times an unequal pulse, with indigestion and flatulency, and occasional asthma; he was seized two days ago with diarrhoea, and this morning with sickness, and his pulse was every way unequal. After an emetic his pulse still continued very intermittent and unequal. He then took some breakfast of toast and butter, and tea, and to my great surprise his pulse became immediately perfectly regular, about 100 in a minute, and not weak, by this stimulus on his stomach.

A person, who for many years had had a frequent intermission of his pulse, and occasional palpitation of his heart, was relieved from them both for a time by taking about four drops of a saturated solution of arsenic three or four times a day for three or four days. As this intermission of the pulse is occasioned by the direct association of the motions of the heart
with

with those of the stomach, the indication of cure must be to strengthen the action of the stomach by the bark. Spice. Moderate quantities of wine. A blister. Half a grain of opium twice a day. Solution of arsenic ?

19. *Febris inirritativa*. Inirritative fever described in Class I. 2. 1. 1. belongs to this place, as it consists of disordered trains and tribes of associated irritative motions, with lessened actions of the associated organs. In this fever the pulsations of the heart and arteries are weakened or lessened, not only in the cold paroxysm, as in the irritative fever, but also in the hot paroxysm. The capillary arteries or glands have their actions nevertheless increased after the first cold fit, as appears by the greater production of heat, and the glow of arterial blood, in the cutaneous vessels ; and lastly, the action of the stomach is much impaired or destroyed, as appears by the total want of appetite to solid food. Whence it would seem, that the torpid motions of the stomach, whatever may occasion them, are a very frequent cause of continued fever with weak pulse ; and that these torpid motions of the stomach do not sufficiently excite the sensorial power of association, which contributes in health to actuate the heart and arteries along with the irritation produced by the stimulus of the blood ; and hence the actions of these organs are weaker. And lastly, that the accumulation of the sensorial power of association, which ought to be expended on the motions of the heart

heart and arteries, becomes now exerted on the cutaneous and pulmonary capillaries. See Supplement 1. 8. and Sect. XXXV. 1. 1. and XXXIII. 2. 10.

I have dwelt longer on the vertiginous diseases in this genus, both because of their great intricacy, and because they seem to open a road to the knowledge of fever, which consists of associated trains and tribes of irritative or sensitive motions, which are sometimes mixed with the vertiginous ones, and sometimes separate from them:

ORDO II.

Decreased Associate Motions.

GENUS II.

Catenated with Sensitive Motions.

IN this genus the sensorial power of association is exerted with less energy, and thence the actions produced by it are less than natural; and pain is produced in consequence, according to the fifth law of animal causation, Sect. IV. This pain is generally attended with coldness of the affected part, and is seldom succeeded by inflammation of it. This decreased action of the secondary link of the associated motions, belonging to this genus, is owing to the previous exhaustion of sensorial power either in the increased actions of the primary link of the associated motions, or by the pain which attends them; both which are

frequently the consequence of the stimulus of something external to the affected fibres.

As pain is produced either by excess or defect of the natural exertions of the fibres, it is not, considered separately, a criterion of the presence of either. In the associations belonging to this genus the sensation of pain or pleasure produces or attends the primary link of the associated motions, and very often gives name to the disease.

When great pain exists without causing any fibrous motions, I conjecture that it contributes to exhaust or expend the general quantity of sensorial power; because people are fatigued by enduring pain, till at length they sleep. Which is contrary to what I had perhaps erroneously supposed in Sect. XXXV. 2. 3. If it causes fibrous motions, it then takes the name of sensation, according to the definition of sensation in Sect. II. 2. 9.; and increased fibrous action or inflammation is the consequence. This circumstance of the general exhaustion of sensorial power by the existence of pain will assist in explaining many of the diseases of this genus.

Many of the canals of the body, as the urethra, the bile-duct, the throat, have the motions of their two extremities associated by having been accustomed to feel pleasurable or painful sensations at the same time or in succession. This is termed sensitive association, though those painful or pleasurable sensations do not cause the motions, but only attend them; and are thus perhaps, strictly speaking, only catenated with them.

SPECIES.

1. *Torpor genæ a dolore dentis.* In tooth-ach there is generally a coldness of the cheek, which is sensible to the hand, and is attended in some degree with the pain of cold. The cheek and tooth have frequently been engaged in pleasurable action at the same time during the masticating of our food; whence they have acquired sensitive associations. The torpor of the cheek may have for its cause the too great expenditure of sensorial power by the painful sensation of the membranes of the diseased tooth; whence the membranes of the cheek associated with those of the alveolar process are deprived of their natural share of it, and become torpid; thus they produce less secretions, and less heat, and the pain of cold is the consequence. This torpor of the vessels of the cheek cannot be produced by the activity of the sensorial power of sensation; for then they would act more violently than natural, or become inflamed. And though the pain by exhausting so much sensorial power may be a remote cause, it is the defect of the power of association, which is the immediate cause of the torpor of the cheek.

After some hours this pain occasioned by the torpor of the vessels of the cheek either gradually ceases along with the pain of the diseased tooth; or, by the accumulation of sensorial power during their state of torpor, the capillaries of the cheek act with greater violence, and produce more secretions, and heat, and consequent tumour, and inflammation. In this

state the pain of the diseased tooth ceases; as the sensorial power of sensation is now expended on the inflamed vessels of the cheek. It is probable that most other internal membranous inflammations begin in a similar manner; whence there may seem to be a double kind of sensitive association; first, with decreased action of the associated organ, and then with increased action of it; but the latter is in this case simply the consequence of the former; that is, the tumor or inflammation of the cheek is in consequence of its previous quiescence or torpor.

2. *Stranguria a dolore vesicæ.* The strangury, which has its origin from pain at the neck of the bladder, consists of a pain in the external extremity of the urethra or of the glans penis of men, and probably in the external termination of the urethra or of the clitoris of women; and is owing to the sympathy of these with some distant parts, generally with the other end of the urethra; an endeavour and difficulty of making water attend this pain.

Its remote cause is from the internal or external use of cantharides, which stimulate the neck of the bladder; or from a stone, which whenever it is pushed into the neck of the bladder, gives this pain of strangury, but not at other times; and hence it is felt most severely in this case after having made water.

The sensations or sensitive motions of the glans penis, and of the sphincter of the bladder, have been accustomed to exist together during the discharge of
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the urine; and hence the two ends of the urethra sympathize by association. When there is a stone at the neck of the bladder, which is not so large or rough as to inflame the part, the sphincter of the bladder becomes stimulated into pain; but as the glans penis is for the purposes of copulation more sensitive than the sphincter of the bladder, as soon as it becomes affected with pain by the association above mentioned, the sensation at the neck of the bladder ceases; and then the pain of the glans penis would seem to be associated with the irritative motions only of the sphincter of the bladder, and not with the sensitive ones of it. But a circumstance similar to this occurs in epileptic fits, which at first are induced by disagreeable sensation, and afterwards seem to occur without previous pain, from the suddenness in which they follow and relieve the pain, which occasioned them. From this analogy I imagine the pain of the glans penis is associated with the pain of the sphincter of the bladder; but that *as soon as the greater pain in a more sensible part is produced; the lesser one, which occasioned it, ceases*; and that this is one of the laws of sensitive association. See Sect. XXXV. 2. 1.

A young man had by an accident swallowed a large spoonful or more of tincture of cantharides; as soon as he began to feel the pain of strangury, he was advised to drink large quantities of warmish water; to which, as soon as it could be got, some gum arabic was added. In an hour or two he drank by intervals of a few minutes about two gallons of water, and discharged his urine every four or five minutes. A

little blood was voided towards the end, but he suffered no ill consequences.

M. M. Warm water internally. Clysters of warm water. Fomentation. Opium. Solution of fixed alkali supersaturated with carbonic acid. A bougie may be used to push back a stone into the bladder. See Class I. 1. 3. 10.

3. *Stranguria convulsiva*. The convulsive strangury, like that before described, is probably occasioned by the torpor or defective action of the painful part in consequence of the too great expenditure of sensorial power on the primary link of the associated motions, as no heat or inflammation attends this violent pain. This kind of strangury recurs by stated periods, and sometimes arises to so great a degree, that convulsion or temporary madness terminates each period of it. It affects women oftener than men, is attended with cold extremities without fever, and is distinguished from the stone of the bladder by the regularity of its periods, and by the pain being not increased after making water.

On introducing the catheter sometimes part of the urine will come away and not the whole, which is difficult to explain; but may arise from the weakness of the muscular fibres of the bladder; which are not liable suddenly to contract themselves so far as to exclude the whole of the urine. In some old people, who have experienced a long retention of urine, the bladder never regains the power of completely emptying itself; and many who are beginning to be weak
from

from age can make water a second time, a few minutes after they supposed they had emptied the bladder.

I have believed this pain to originate from sympathy with some distant part, as from ascarides in the rectum, or from piles in women; or from caruncles in the urethra about the caput gallinaginis in men; and that the pain has been in the glans or clitoris by reverse sympathy of these more sensible parts with those above mentioned.

M. M. Venesection. Opium in large quantities. Warm bath. Balsams. Bark. Tincture of cantharides. Bougie, and the treatment for hæmorrhoids. Leeches applied to the sphincter ani. Aerated alkaline water. Soap and sal soda. Opium in clysters given an hour before the expected return. Smoke of tobacco in clysters. Arsenic?

4. *Dolor termini intestinalis ductus choledochi.* Pain at the intestinal end of the gall-duct. When a gall-stone is protruded from the gall-bladder a little way into the end of the gall-duct, the pain is felt at the other end of the gall-duct, which terminates in the duodenum. For the actions of the two terminations of this canal are associated together from the same streams of bile passing through them in succession, exactly as the two terminations of the urethra have their actions associated, as described in Species 2 and 3 of this genus. But as the intestinal termination of the bile-duct is made more sensible for the purpose of bringing down more bile, when it is stimulated by

new supplies of food from the stomach, it falls into violent pain from association; and then the pain on the region of the gall-bladder ceases, exactly as above explained in the account of the pain of the glans penis from a stone in the sphincter [of the bladder.

The common bile-duct opens into the intestine exactly at what is called the pit of the stomach; and hence it has sometimes happened, that this pain from association with the sensation of a gall-stone at the other end of the bile-duct has been mistaken for a pain of the stomach.

For the method of cure see Class I. 1. 3. 8. to which should be added the use of strong electric shocks passed through the bile-duct from the pit of the stomach to the back, and from one side to the other. A case of the good effect of electricity in the jaundice is related in Sect. XXX. 2. And another case, where it promoted the passage of a painful gall-stone, is described by Dr. Hall, experienced on himself. Trans. of the College at Philadelphia, Vol. 1. p. 192.

Half a pint of warm water two or three times a day is much recommended to dilute the inspissated bile.

5. *Dolor pharyngis ab acido gastrico.* The two ends of the throat sympathize by sensitive association in the same manner as the other canals above mentioned, namely, the urethra and the bile-duct; hence when too great acidity of undigested aliment, or the car-
bonic

bonic acid air, which escapes in fermentation, stimulates the cardia ventriculi, or lower end of the gula, into pain; the pharinx, or upper end of it, is affected with greater pain, or a disagreeable sensation of heat.

6. *Pruritus narium a vermibus.* The itching of the nose from worms in the intestines is another curious instance of the sensitive associations of the motions of membranes; especially of those which constitute the canals of the body. Previous to the deglutition of agreeable food, as milk in our earliest infancy, an agreeable odour affects the membrane, which lines the nostrils; and hence an association seems to take place between the agreeable sensations produced by food in the stomach and bowels, and the agreeable sensations of the nostrils. The existence of ascarides in the rectum I believe produces this itching of the nostrils more than the worms in other parts of the intestines; as we have already seen, that the terminations of canals sympathize more than their other parts, as in the urethra and gall-duets. See Class I. i. 5. 9. IV, 1. 2. 9.

7. *Cephalæa.* Head-ach. In cold fits of the ague, the head-ach arises from consent with some torpid viscus, like the pain of the loins. After drunkenness the head-ach is very common, owing to direct sympathy of the membranes of the head with those of the stomach; which is become torpid after the too violent stimulus

stimulus of the preceding intoxication ; and is hence removable by spirit of wine, or opium, exhibited in smaller quantities. In some constitutions these head-achs are induced, when the feet are exposed to much external cold ; in this case the feet should be covered with oiled silk, which prevents the evaporation of the perspirable matter, and thence diminishes one cause of external cold.

M. M. Valerian in powder two drams three or four times a day is recommended. The bark. Chalybeates. A grain of opium twice a day for a long time. From five to ten drops of the saturated solution of arsenic two or three times a day. See Class I. 2. 4. 11. A lady once assured me, that when her head-ach was coming on, she drank three pints (pounds) of hot water, as hastily as she could ; which prevented the progress of the disease. A solution of arsenic is recommended by Dr. Fowler of York. Very strong errhines are said sometimes to cure head-achs taken at the times the pain recurs, till a few drops of blood issue from the nostrils. As one grain of turpeth mineral (vitriolic calx of mercury) mixed with ten grains of fine sugar. Euphorbium or Cayan pepper mixed with sugar, and used with caution as an errhine. See the M. M. of the next species.

8. *Hemicrania*. Pain on one side of the head. This disease is attended with cold skin, and hence whatever may be the remote cause, the immediate one seems to be want of stimulus, either of heat or distension, or of some other unknown stimulus in the
painful

painful part ; or in those, with which it is associated. The membranes in their natural state are only irritable by distention ; in their diseased state, they are sensible like muscular fibres. Hence a diseased tooth may render the neighbouring membranes sensible, and is frequently the cause of this disease.

Sometimes the stomach is torpid along with the pained membrane of the head ; and then sickness and inappetency attends either as a cause or consequence. The natural cure of hemicrania is the accumulation of sensorial power during the rest or sickness of the patient. Mrs. — is frequently liable to hemicrania with sickness, which is probably owing to a diseased tooth ; the paroxysm occurs irregularly, but always after some previous fatigue, or other cause of debility. She lies in bed, sick, and without taking any solid food, and very little of fluids, and those of the aqueous kind, and, after about 48 or 50 hours, rises free from complaint. Similar to this is the recovery from cold paroxysms of fever, from the torpor occasioned by fear, and from syncope ; which are all owing to the accumulation of sensorial power during the inactivity of the system. Hence it appears, that, though when the sensorial power of volition is much exhausted by fatigue, it can be restored by eight or ten hours of sleep ; yet, when the sensorial power of irritation is exhausted by fatigue, that it requires two whole solar or lunar days of rest, before it can be restored.

The late Dr. Monro asserted in his lectures, that he cured the hemicrania, or megrim, by a strong vomit, and a brisk purge immediately after it. This method succeeds best if opium and the bark are given in due quantity after the operation of the cathartic; and with still more certainty, if bleeding in small quantity is premised, where the pulse will admit of it. See Sect. XXXV. 2. 1.

The pain generally affects one eye, and spreads a little way on that side of the nose, and may sometimes be relieved by pressing or cutting the nerve, where it passes into the bone of the orbit above the eye. When it affects a small defined part on the parietal bone on one side, it is generally termed *Clavus hystericus*, and is always I believe owing to a diseased *dens molaris*. The tendons of the muscles, which serve the office of mastication, have been extended into pain at the same time, that the membranous coverings of the roots of the teeth have been compressed into pain, during the biting or mastication of hard bodies. Hence when the membranes, which cover the roots of the teeth, become affected with pain by a beginning decay, or perhaps by the torpor or coldness of the dying part of the tooth, the tendons and membranous fascia of the muscles about the same side of the head become affected with violent pain by their sensitive associations: and as soon as this associated pain takes place, the pain of the tooth entirely ceases, as explained in the second species of this genus.

A remark.

A remarkable circumstance attends this kind of hemicrania, viz. that it recurs by periods like those of intermittent fevers, as explained in the Section on Catenation of Motions; these periods sometimes correspond with alternate lunar or solar days like tertian agues, and that even when a decaying tooth is evidently the cause; which has been evinced by the cure of the disease by extracting the tooth. At other times they observe the monthly lunations, and seem to be induced by the debility, which attends menstruation.

The dens sapientiæ, or last tooth of the upper jaw, frequently decays first, and gives hemicrania over the eye on the same side. The first or second grinder in the under-jaw is liable to give violent pain about the middle of the parietal bone, or side of the head, on the same side, which is generally called the Clavus hystericus, of which an instructive case is related in Sect. XXXV. 2. 1.

M. M. Detect and extract the diseased tooth. Cut the affected nerve, or stimulate the diseased membrane by acupuncture. Venesection to six ounces by the lancet or by leeches. A strong emetic and a subsequent cathartic; and then an opiate and the bark. Pass small electric shocks through the pained membrane, and through the teeth on the same side. Apply vitriolic ether externally, and a grain of opium with camphor internally, to the cheek on the affected side, where a diseased tooth may be suspected. Foment the head with warm vinegar. Drink two large
 spoonfuls

spoonfuls of vinegar. Stimulate the gums of the suspected teeth by oil of cloves, by opium. See Class I. 1. 4. 4. Snuff volatile spirit of vinegar up the nostrils. Lastly, in permanent head-achs, as in permanent vertigo, I have seen good effect by the use of mercurial ointment rubbed on the shaved head or about the throat, till a mild salivation commences, which by inflaming the membranes of the teeth may prevent their irritative sympathy with those of the cranium. Thus by inflaming the tendon, which is the cause of locked jaw, and probably by inflaming the wound, which is the cause of hydrophobia, those diseases may be cured, by disuniting the irritative sympathy between those parts, which may not possess any sensitive sympathy. This idea is well worth our attention.

Otalgia. Ear-ach is another disease occasioned by the sympathy of the membranes of the ear with those which invest or surround a decaying tooth, as I have had frequent reason to believe; and is frequently relieved by filling the ear with tincture of opium. See Class I. 2. 4.

9. *Dolor humeri in hepaticide.* In the efforts of excluding the fæces and urine the muscles of the shoulders are exerted to compress the air in the lungs, that the diaphragm may be pressed down. Hence the distention of the tendons or fibres of these muscles is associated with the distention of the tendons or fibres of

of

of the diaphragm ; and when the latter are pained by the enlargement or heat of the inflamed liver, the former sympathize with them. Sometimes but one shoulder is affected, sometimes both ; it is probable that many other pains, which are termed rheumatic, have a similar origin, viz. from sensitive associations.

As no inflammation is produced in consequence of this pain of the shoulder, it seems to be owing to inaction of the membranous part from defect of the sensorial power of association, of which the primary link is the inflamed membrane of the liver ; which now expends so much of the sensorial power in general by its increased action, that the membranes about the shoulder, which are links of association with it, become deprived of their usual share, and consequently fall into torpor.

10. *Torpor pedum in eruptione variolarum.* At the commencement of the eruption of the small-pox, when the face and breast of children are very hot, their extremities are frequently cold. This I ascribe to sensitive association between the different parts of the skin ; whence when a part acts too violently, the other part is liable to act too weakly ; and the skin of the face being affected first in the eruption of the small-pox, the skin of the feet becomes cold in consequence by reverse sympathy.

M. M. Cover the feet with flannel, and expose the face and bosom to cool air, which in a very short time both warms the feet and cools the face ; and hence

what

what is erroneously called a rash, but which is probably a too hasty eruption of the small-pox, disappears; and afterwards fewer and more distinct eruptions of the small-pox supervene.

11. *Testium dolor nephriticus.* The pain and retraction of the testicle on the same side, when there is a stone in the ureter, is to be ascribed to sensitive association; whether the connecting cause be a branch of the same nerve, or from membranes, which have been frequently affected at the same time.

12. *Dolor digiti minimi sympatheticus.* When any one accidentally strikes his elbow against any hard body, a tingling pain runs down to the little finger end. This is owing to sensitive association of motions by means of the same branch of a nerve, as in hemiplegia from a decaying tooth the pain is owing to the sensitive association of tendons or membranes.

13. *Dolor brachii in hydrope pectoris.* The pain in the left arm which attends some dropsies of the chest, is explained in Sect XXIX. 5. 2. 10. which resembles the pain of the little finger from a percussion of the nerve at the elbow in the preceding article. A numbness of this kind is produced over the whole leg, when the crural nerve is much compressed by sitting for a time with one leg crossed over the other.

Mr. —, about sixty, had for two years been affected with difficulty of respiration on any exertion,

with pain about the sternum, and of his left arm; which last was more considerable than is usual in dropfy of the chest; some months ago the pain of his arm, after walking a mile or two, became excessive, with coldness and numbness; and on the next day the back of the hand, and a part of the arm swelled, and became inflamed, which relieved the pain; and was taken for the gout, and continued several days. He after some months became dropsical both in respect to his chest and limbs, and was six or seven times perfectly relieved by one dram of saturated tincture of digitalis, taken two or three times a day for a few days in a glass of peppermint water. He afterwards breathed oxygen gas undiluted, in the quantity of six or eight gallons a day for three or four weeks without any effect, and sunk at length from general debility.

In this instructive case I imagine the pressure or stimulus of one part of the nerve within the chest caused the other part, which serves the arm, to become torpid, and consequently cold by sympathy; and that the inflammation was the consequence of the previous torpor and coldness of the arm, in the same manner as the swelling and inflammation of the cheek in tooth-ach, in the first species of this genus; and that many rheumatic inflammations are thus produced by sympathy with some distant part.

14. *Diarrhœa a dentitione.* The diarrhœa, which frequently attends dentition, is the consequence of

indigestion; the aliment acquires chemical changes, and by its acidity acts as a cathartic; and changes the yellow bile into green, which is evacuated along with indigested parts of the coagulum of milk. The indigestion is owing to the torpor of the stomach and intestines caused by their association with the membranes of the gums, which are now stimulated into great exertion with pain; both which contribute to expend the general quantity of sensorial power, which belongs to this membranous association; and thus the stomach and intestines act with less than their natural energy. This is generally esteemed a favourable symptom in difficult dentition, as the pain of the alveolar membranes exhausts the sensorial power without producing convulsions for its relief. See Class I. 1. 4. 5. And the diarrhœa ceases, as the tooth advances.

ORDO II.

Decreased Associate Motions.

GENUS III.

Catenated with Voluntary Motions.

SPECIES.

2. *Titubatio linguæ.* Impediment of speech is owing to the associations of the motions of the organs of speech being interrupted or dissevered by ill-employed sensation or sensitive motions, as by awe, bashfulness, ambition of shining, or fear of not succeeding, and the person uses voluntary efforts in vain to regain the broken associations, as explained in Sect. XVII. 1. 10. and XVII. 2. 10.

The broken association is generally between the first consonant and the succeeding vowel; as in endeavouring to pronounce the word *parable*, the *p* is voluntarily repeated again and again; but the remainder of the word does not follow, because the association between it and the next vowel is dissevered.

M. M. The art of curing this defect is to cause the stammerer to repeat the word, which he finds difficult to speak, eight or ten times without the initial letter, in a strong voice, or with an aspirate before it, as *arable*, or *harable*; and at length to speak it very softly with the initial letter *p*, *parable*. This should be practised for weeks or months upon every word, which the stammerer hesitates in pronouncing.

To this should be added much commerce with mankind, in order to acquire a carelessness about the opinions of others.

2. *Chorea St. Viti.* In the St. Vitus's dance the patient can at any time lie still in bed, which shews the motions not to be convulsive; and he can at different times voluntarily exert every muscle of his body; which evinces, that they are not paralytic. In this disease the principal muscle in any designed motions obeys the will; but those muscles, whose motions were associated with the principal one, do not act; as their association is dislevered, and thus the arm or leg is drawn outward, or inward, or backward, instead of upward or forward, with various gesticulations exactly resembling the impediment of speech.

This disease is frequently left after the itch has been too hastily cured. See *Convulsio dolorifica*, Class III. 1. 1. 6. A girl about eighteen, after wearing a mercurial girdle to cure the itch, acquired the *Chorea St. Viti* in so universal a manner, that her speech became affected as well as her limbs; and there was evidently a disunion of the common trains of ideas; as the itch was still among the younger children of the family, she was advised to take her sister as a bed-fellow, and thus received the itch again; and the dance of St. Vitus gradually ceased. See Class II. 1. 5. 6.

M. M. Give the patient the itch again. Calomel a grain every night, or sublimate a quarter of a grain twice a day for a fortnight. Steel. Bark. Warm-bath. Cold-bath. Opium. Venesection once at the beginning of the disease. Electricity. Perpetual flow and repeated efforts to move each limb in the designed direction, as in the titubatio linguæ above described.

3. *Rifus*. Laughter is a perpetual interruption of voluntary exertion by the interposition of pleasurable sensation; which not being checked by any important consequences rises into pain, and requires to be relieved or moderated by the frequent repetition of voluntary exertion. See Sect. XXXIV. 1. 4. and Class III. 1. 1. 4. and IV. 1. 3. 3.

4. *Tremor ex irâ*. The trembling of the limbs from anger. The interruption of the voluntary associations of motions by anger, originates from too great a part of the sensorial power being exerted on the organs of sense; whence the muscles, which ought to support the body upright, are deprived of their due quantity, and tremble from debility. See Class III. 2. 1. 1.

5. *Rubor ex irâ*. Redness from anger. Anger is an excess of aversion, that is of voluntariness not yet employed. It is excited by the pain of offended pride; when it is employed it becomes outrage, cruelty,

cruelty, insanity. The cutaneous capillaries, especially those of the face, are more mobile, that is, more easily excited into increased action, or more easily become torpid, from less variation of sensorial power, than any other parts of the system, which is owing to their being perpetually subject to the vicissitudes of heat and cold, and of extension and corrugation. Hence, when an excess of voluntariness exists without being immediately expended in the actions of the large muscles, the capillary arteries and glands acquire more energetic action, and a flushed skin is produced, with increased secretion of perspirable matter, and consequent heat, owing to the pause or interruption of voluntary action; and thus the actions of these cutaneous vessels become associated between the irascible ideas and irascible muscular actions, which are thus for a time interrupted.

6. *Rubor criminati.* The blushing of accused people, whether guilty or not, appears to be owing to circumstances similar to that of anger; for in these situations there is always a sudden voluntariness, or wish, of clearing their characters arises in the mind of the accused person; which, before an opportunity is given for it to be expended on the large muscles, influences the capillary arteries and glands, as in the preceding article. Whence the increased actions of the capillaries, and the consequent redness and heat, become exerted between the voluntary ideas of self-defence, and the muscular actions necessary for that purpose;

purpose ; which last are thus for a time interrupted or delayed.

Even in the blush of modesty or bashfulness there is a self-condemnation for some supposed defect or indecorum, and a sudden voluntariness, or wish, of self-defence ; which not being expended in actions of the larger muscles excites the capillaries into action ; which in these subjects are more mobile than in others.

The blush of young girls on coming into an assembly room, where they expect their dress, and steps, and manner to be examined, as in dancing a minuet, may have another origin ; and may be considered as a hot fit of returning confidence, after a previous cold fit of fear.

7. *Tarditas paralytica*. By a stroke of the palsy or apoplexy it frequently happens, that those ideas, which were associated in trains, whose first link was a voluntary idea, have their connection dissevered ; and the patient is under the necessity by repeated efforts slowly to renew their associations. In this situation those words, which have the fewest other words associated with them, as the proper names of persons or places, are the most difficult to recollect. And in those efforts of recollection the word opposite to the word required is often produced, as hot for cold, winter for summer, which is owing to our associating our ideas of things by their opposites as well as by their similitudes, and in some instances perhaps

more frequently, or more forcibly. Other paralytic patients are liable to give wrong names to external objects, as using the word pigs for sheep, or cows for horses; in this case the association between the idea of the animal and the name of it is disordered; but the idea of the class or genus of the thing remains; and he takes a name from the first of the species, which presents itself, and sometimes can correct himself, till he finds the true one.

8. *Tarditas senilis*. Slowness of age. The difficulty of associating ideas increases with our age; as may be observed from old people forgetting the business of the last hour, unless they impress it strongly, or by frequent repetition, though they can well recollect the transactions of their youth. I saw an elderly man, who could reason with great clearness and precision and in accurate language on subjects, which he had been accustomed to think upon; and yet did not know, that he had rang the bell by his fire-side in one minute afterwards; nor could then recollect the object he had wanted, when his servant came.

Similar to this is the difficulty which old people experience in learning new bodily movements, that is, in associating new muscular actions, as in learning a new trade or manufactory. The trains of movements, which obey volition, are the last which we acquire; and the first, which are disassociated.

ORDO II.

Decreased Associate Motions.

GENUS IV.

Catenated with External Influences.

As the diseases, which obey solar or lunar periods, commence with torpor or inactivity, such as the cold paroxysms of fevers, the torpor and consequent pain of hemicrania, and the pains which precede the fits of epilepsy and convulsion, it would seem, that these diseases are more generally owing to the diminution than to the excess of solar or lunar gravitation; as the diseases, which originate from the influence of the matter of heat, are much more generally in this country produced by the defect than by the excess of that fluid.

The periodic returns of so many diseases coincide with the diurnal, monthly, and annual rounds of time; that any one, who would deny the influence of the sun and moon on the periods of quotidian, tertian, and quartan fevers, must deny their effect on the tides, and on the seasons. It has generally been believed, that solar and lunar effect was exerted on the blood; which was thus rendered more or less stimulant to the system, as described in Sect. XXXII. 6. But as the fluid matter of gravitation permeates and covers all things, like the fluid matter of heat; I am induced to believe, that gravitation acts in its medium state rather as a *causa sine quâ non* of animal motion, like heat;

heat; which may disorder the system chemically or mechanically, when it is diminished; but may nevertheless stimulate it, when increased, into animal exertion.

Without heat and motion, which some philosophers still believe to be the same thing, as they so perpetually appear together, the particles of matter would attract and move towards each other, and the whole universe freeze or coalesce into one solid mass. These therefore counteract the gravitation of bodies to one centre; and not only prevent the planets from falling into the sun, but become either the efficient causes of vegetable and animal life, or the causes without which life cannot exist; as by their means the component particles of matter are enabled to slide over each other with all the various degrees of fluidity and repulsion.

As the attraction of the moon countervails or diminishes the terrene gravitation of bodies on the surface of the earth, a tide rises on that side of the earth which is turned towards the moon; and follows it, as the earth revolves. Another tide is raised at the same time on the opposite side of the revolving earth; which is owing to the greater centrifugal motion of that side of the earth, which counteracts the gravitation of bodies near its surface. For the earth and moon may be considered as two cannon balls of different sizes held together by a chain, and revolving once a month round a common center of gravity between them, near the earth's surface; at

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the same time that they perform their annual orbits round the sun. Whence the centrifugal force of that side of the earth, which is farthest from this center of motion, round which the earth and moon monthly revolve, is considerably greater, than the centrifugal force of that side of the earth, which is nearest it; to which should be added, that this centrifugal force not only contributes to diminish the terrene gravitation of bodies on the earth's surface on that side furthest from this center of motion, but also to increase it on that side, which is nearest it.

Another circumstance, which tends to raise the tide on the part of the earth's surface, which is most distant from the moon, is, that the attraction of the moon is less on that part of the ocean, than it is on the other parts of the earth. Thus the moon may be supposed to attract the water on the side of the earth nearest it with a power equal to three; and to attract the central parts of the earth with a power equal to two; and the water on the part of the earth most distant from the moon with a power only equal to one. Hence on the side of the earth most distant from the moon, the moon's attraction is less, and the centrifugal force round their common centre of motion is greater; both which contribute to raise the tides on that side of the earth. On the side of the earth nearest the moon, the moon's attraction is so much greater as to raise the tides; though the centrifugal force of the surface of the earth round their common centre of motion in some degree opposes this effect.

On these accounts, when the moon is in the zenith or nadir, the gravitation of bodies on the earth's surface will be greatest at the two opposite quadratures; that is, the greatest gravitation of bodies on the earth's surface towards her center during the lunar day is about six hours and an half after the southing, or after the northing of the moon.

Circumstances similar to these, but in a less degree, must occur in respect to the solar influence on terrestrial bodies; that is, there must be a diminution of the gravity of bodies near the earth's surface at noon, when the sun is over them; and also at midnight from the greater centrifugal force of that side of the earth, which is most distant from the center, round which the earth moves in her annual orbit, than on the side nearest that center. Whence it likewise follows, that the gravitation of bodies towards the earth is greatest about six hours after noon, and after midnight.

Now when the sun and moon have their united gravitation on the same side of the earth, as at the new moon; or when the solar attraction coincides with the greater centrifugal motion of that side of the earth, which is furthest distant from the moon, as at the full moon; and when this happens about noon or midnight, the gravitation of terrene bodies towards the earth will be greater about six hours after noon, and after midnight, than at any other part of the lunar period; because the attraction of both these luminaries is then exerted on those sides of the earth over
which

which they hang, which at other times of the month are more or less exerted on other parts of it.

Lastly, as heat and motion counteract the gravitation of the particles of bodies to each other, and hence become either the efficient causes of vegetable and animal life, or the causes without which life cannot exist, it seems to follow, that when our gravitation towards the earth's center is greatest, the powers of life should be the least; and hence that those diseases, which begin with torpor, should occur about six hours after the solar or lunar noon, or about six hours after the solar or lunar midnight; and this most frequently about six hours after or before the new or full moon; and especially when these happen at noon or at midnight; or lastly, according to the combination of these powers in diminishing or increasing the earth's attraction to bodies on its surface.

The returns or exacerbations of many fevers, both irritative and inflammatory, about six in the evening, and of the periodic cough described in Sect. XXXVI. 3. 9. countenance this theory. Tables might be made out to shew the combined powers of the sun and moon in diminishing the gravitation of bodies on the earth's surface, at every part of their diurnal, monthly, and annual periods; and which might facilitate the elucidation of this subject. But I am well aware of the difficulty of its application to diseases, and hope these conjectures may induce others to publish more numerous observations, and more conclusive reasonings.

SPECIES.

1. *Somni periodus.* The periods of sleeping and of waking are shortened or prolonged by so many other circumstances in animal life, besides the minute difference between diurnal and nocturnal solar gravitation, that it can scarcely be ascribed to this influence. At the same time it is curious to observe, that vegetables in respect to their times of sleeping more regularly observe the hour of the day, than the presence or absence of light, or of heat, as may be seen by consulting the calendar of Flora. Botanic Garden, Part II. Canto 2. l. 165. note.

Some diseases, which at first sight might be supposed to be influenced by solar periods, seem to be induced by the increasing sensibility of the system to pain during our sleeping hours; as explained in Sect. XVIII. 15. Of these are the fits of asthma, of some epilepsies, and of some hæmoptoes; all which disturb the patient after some hours sleep, and are therefore to be ascribed to the increase of our dormant sensibility. There may likewise be some doubt, whether the commencement of the pain of gout in the foot, as it generally makes its attack after sleep, should be ascribed to the increased sensibility in sleep, or to solar influence?

M. M. When asthmatic or epileptic fits or hæmoptoe occur after a certain number of hours of sleep, the patient should be forcibly awakened before the expected time by an alarm clock, and drink a cup of

chocolate or lemonade.—Or a grain of opium should be given at going to bed.—In one case to prevent the too great increase of sensibility by shortening the time of sleep; and in the other by increasing the irritable motions, and expending by that means a part of the sensorial power.

2. *Studii inanis periodus.* Class III. 1. 2. 2. The cataleptic spasm which preceded the reverie and somnambulation in the patient whose case is related in Sect. XIX. 2. occurred at exactly the same hour, which was about eleven in the morning for many weeks; till those periods were disturbed by large doses of opium; and must therefore be referred to some effect of solar gravitation. In the case of Master A. Sect. XXXIV. 3. as the reverie began early in the morning during sleep, there may be a doubt, whether this commenced with torpor of some organ catenated with solar gravitation; or was caused by the existence of a previous torpid part, which only became so painful as to excite the exertions or reverie by the perpetual increase of sensibility during the continuance of sleep, as in some fits of epilepsy, asthma, and hæmoptoe mentioned in the preceding article.

3. *Hemicranie periodus.* Periods of hemicrania. Class IV. 2. 2. 8. The torpor and consequent pain of some membranes on one side of the head, as over one eye, is frequently occasioned by a decaying tooth, and is liable to return every day, or on alternate days

at solar or lunar periods. In this case large quantities of the bark will frequently cure the disease, and especially if preceded by venesection and a brisk cathartic; but if the offending tooth can be detected, the most certain cure is its extraction. These partial head-achs are also liable to return at the greater lunar periods, as about once a month. Five drops from a two-ounce phial of a saturated solution of arsenic twice a day for a week or two have been said to prevent the returns of this disease. See a Treatise on Arsenic by Dr. Fowler, of York. Strong errhines have also been recommended.

4. *Epilepsiæ dolorificæ periodus.* Class III. I. 1. 8. The pain which induces after about an hour the violent convulsions or insanity, which constitute the painful epilepsy, generally observe solar diurnal periods for four or five weeks, and are probably governed by solar and lunar times in respect to their greater periods; for I have observed that the daily paroxysms, unless disturbed by large doses of opium, recur at very nearly the same hour, and after a few weeks the patients have recovered to relapse again at the interval of a few months. But more observations are wanted upon this subject, which might be of great advantage in preventing the attacks of this disease; as much less opium given an hour before its expected daily return will prevent the paroxysm, than is necessary to cure it, after it has commenced.

5. *Convulsionis*

5. *Convulsionis dolorificæ periodus.* Class III. 1. 1. 6. The pains, which produce these convulsions, are generally left after rheumatism, and come on when the patients are become warm in bed, or have been for a short time asleep, and are therefore perhaps rather to be ascribed to the increasing sensibility of the system during sleep, than to solar diurnal periods, as in Species first and second of this Genus.

6. *Tussis periodicæ periodus.* Periodic cough, Class IV. 2. 1. 9. returns at exact solar periods; that described in Sect. XXXVI. 3. 9. recurred about seven in the afternoon for several weeks, till its periods were disturbed by opium, and then it recurred at eleven at night for about a week, and was then totally destroyed by opium given in very large quantities, after having been previously for a few days omitted.

7. *Catamenia periodus.* Periods of menstruation. The correspondence of the periods of the catamenia with those of the moon was treated of in Sect. XXXII. 6. and can admit of no more doubt, than that the returns of the tides are governed by lunar influence. But the manner in which this is produced, is less evident; it has commonly been ascribed to some effect of the lunar gravitation on the circulating blood, as mentioned in Sect. XXXII. 6. But it is more analogous to other animal phenomena to suppose that the lunar gravitation immediately affects the solids by its influx or stimulus. Which we believe of the fluid ele-

ment of heat, in which we are equally immersed; and of the electric fluid, which also surrounds and pervades us. See Sect. XXXVI. 2. 3.

If the torpor of the uterine veins, which induces the monthly periods of the catamenia, be governed by the increase of terrene gravitation; that is, by the deficiency of the counter-influence of solar and lunar gravitation; why does not it occur most frequently when the terrene gravitation is the greatest, as about six hours after the new moon, and next to that at about six hours after the full moon? This question has its difficulty; first, if the terrene gravitation be greatest about six hours after the new moon, it must become less and less about the same time every lunar day, till the end of the first quarter, when it will be the least; it must then increase daily till the full. After the full the terrene gravitation must again decrease till the end of the third quarter, when it will again be the least, and must increase again till the new moon; that is, the solar and lunar counter-gravitation is greatest, when those luminaries are vertical, at the new moon, and full moon, and least about six hours afterwards. If it was known, whether more menstruations occur about six hours after the moon is in the zenith or nadir; and in the second and fourth quarters of the moon, than in the first and third; some light would be thrown on this subject; which must in that respect wait for future observations.

Secondly, if the lunar influence produces a very small degree of quiescence, suppose of the uterine veins,

veins, at first; and if that recurs at certain periods, as of lunar days, or about 25 hours, even with less power to produce quiescence than at first; yet the quiescence will daily increase by the acquired habit acting at the same time, as explained in Sect. XII. 3. 3. till at length so great a degree of quiescence will be induced as to cause the inaction of the veins of the uterus, and consequent venous hæmorrhage. See Sect. XXXII. 6. Class I. 2. 1. 11. IV. 1. 4. 4. See the introduction to this Genus.

8. *Hæmorrhoidis periodus.* The periods of the piles depend on the torpor of the veins of the rectum, and are believed to recur nearly at monthly intervals. See Sect. XXVII. 2. and Class I. 2. 1. 6.

9. *Podagræ periodus.* The periods of gout in some patients recur at annual intervals, as in the case related above in Class IV. 1. 2. 15. in which the gouty paroxysm returned for three successive years on nearly the same day of the month. The commencement of the pain of each paroxysm is generally a few hours after midnight, and may thence either be induced by diurnal solar periods, or by the increasing sensibility during sleep, as mentioned in the first species of this genus.

10. *Erysipelatis periodus.* Some kinds of erysipelas which probably originate from the association of the cutaneous vessels with a diseased liver, occur at monthly periods, like the hæmorrhoids or piles; and

others at annual periods like the gout; as a torpor of some part I suppose always precedes the erysipelatous inflammation, the periods should accord with the increasing influence of terrene gravitation, as described in the introduction to this Genus, and in Species the seventh of it. Other periods of diseases referable to solar and lunar influence are mentioned in Sect. XXXVI. and many others will probably be discovered by future observations.

11. *Febrium periodus.* Periods of fevers. The commencement of the cold fits of intermittent fevers, and the daily exacerbations of other fevers, so regularly recur at diurnal solar or lunar periods, that it is impossible to deny their connection with gravitation; as explained in Sect. XXXVI. 3. Not only these exacerbations of fever, and their remissions, obey the diurnal solar and lunar periods; but the preparatory circumstances, which introduce fevers, or which determine their crises, appear to be governed by the parts of monthly lunar periods, and of solar annual ones. Thus the variolous fever in the natural small-pox commences on the 14th day, and in the inoculated small-pox on the seventh day. The fever and eruption in the distinct kind take up another quarter of a lutation, and the maturation another quarter.

The fever, which is termed canine madness, or hydrophobia, is believed to commence near the new or full moon; and, if the cause is not then great enough to bring on the disease, it seems to acquire
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some strength, or to lie dormant, till another, or perhaps more powerful luration calls it into action. In the spring, about three or four years ago, a mad dog very much worried one swine confined in a sty, and bit another in the same sty in a less degree; the former became mad, refused his meat, was much convulsed, and died in about four days; this disease commenced in about a month after the bite. The other swine began to be ill about a month after the first, and died in the same manner.

ORDO III.

Retrograde Associate Motions.

GENUS I.

Catenated with Irritative Motions.

THOSE retrograde associate motions, the first links of which are catenated with irritative motions, belong to this genus. All the retrograde motions are consequent to debility, or inactivity, of the organ; and therefore properly belong to the genera of decreased actions both in this and the former classes.

SPECIES.

1. *Diabetes irritata.* When the absorbents of the intestines are stimulated too strongly by spirit of wine, as in the beginning of drunkenness, the urinary absorbents invert their motions. The same

happens from worms in the intestines. In other kinds of diabetes may not the remote cause be the too strong action of the cutaneous absorbents, or of the pulmonary ones? May not in such cases oil externally or internally be of service? or warm bathing for an hour at a time? In hysteric inversions of motion is some other part too much stimulated? or pained from the want of stimulus?

2. *Sudor frigidus in asthmate.* The cause of the paroxysms of humoral asthma is not well understood; I suppose it to be owing to a torpidity or inaction of the absorbents belonging to the pulmonary vessels, as happens probably to other viscera at the commencement of intermittent fevers, and to a consequent accumulation of fluids in them; which at length producing great irritation or uneasy sensation causes the violent efforts to produce the absorption of it. The motions of the cutaneous absorbent vessels by their association with those of the pulmonary ones become retrograde, and effuse upon the skin a fluid, which is said to be viscid, and which adheres in drops.

A few days ago I saw a young man of delicate constitution in what was called a fit of the asthma; he had about two months before had a peripneumony, and had been ever since subject to difficult respiration on exertion, with occasional palpitation of his heart. He was now seized about eight at night after some exertion of mind in his business with cold extremities, and difficulty of breathing. He gradually became worse,

worse, and in about half an hour, the palpitation of his heart and difficult respiration were very alarming; his whole skin was cold and pale, yet he did not shudder as in cold paroxysm of fever; his tongue from the point to the middle became as cold as his other extremities, with cold breath. He seemed to be in the act of dying, except that his pulse continued equal in time, though very quick. He lost three ounces of blood, and took ten drops of laudanum with musk and salt of hartshorn, and recovered in an hour or two without any cold sweat.

There being no cold sweat seems to indicate, that there was no accumulation of serous fluid in the lungs; and that their inactivity, and the coldness of the breath, was owing to the sympathy of the air-cells with some distant part. There was no shuddering produced, because the lungs are not sensible to heat and cold; as any one may observe by going from a warm room into a frosty air, and the contrary. So the steam of hot tea, which scalds the mouth, does not affect the lungs with the sensation of heat. I was induced to believe, that the whole cold fit might be owing to suppuration in some part of the chest; as the general difficulty of breathing seemed to be increased after a few days with pulse of 120, and other signs of empyema. Does the cold sweat, and the occurrence of the fits of asthma after sleep, distinguish the humoral asthma from the cold paroxysm of intermittents, or which attends suppuration, or which precedes inflammation?—I heard a few weeks

afterwards, that he spit up much matter at the time he died.

3. *Diabētēs a timore.* The motions of the absorbent vessels of the neck of the bladder become inverted by their consent with those of the skin; which are become torpid by their reverse sympathy with the painful ideas of fear, as in Sect. XVI. 8. 1. whence there is a great discharge of pale urine, as in hysteric diseases.

The same happens from anxiety, where the painful suspense is continued, even when the degree of fear is small; as in young men about to be examined for a degree at the universities the frequency of making water is very observable. When this anxiety is attended with a sleepless night, the quantity of pale urine is amazingly great in some people, and the micturition very frequent.

M. M. Opium. Joy. Consolations of friendship.

4. *Diarrhœa a timore.* The absorbent vessels of the intestines invert their motions by direct consent with the skin; hence many liquid stools as well as much pale urine are liable to accompany continued fear, along with coldness of the skin. The immediate cause of this is the decreased sensorial power of association, which intervenes between the actions of the absorbents of the cold skin, and those of the intestinal absorbents; the motions of the latter become on that account weakened and at length retrograde.

grade. The remote cause is the torpor of the vessels of the skin catenated with the pain of fear, as explained in Sect. XVI. 8. 1.

The capillaries of the skin consent more generally by direct sympathy with those of the lower intestines, and of the bladder; but by reverse sympathy more generally with those of the stomach and upper intestines. As appears in fevers, where the hot skin accompanies indigestion of the stomach; and in diarrhœas attended with cold extremities.

The remote cause is the torpor of the skin owing to its reverse sympathy with the painful sensual motions, or ideas, of fear; which are now actuated with great energy, so as to deprive the second link of associated motions of their due share of sensorial power. It is also probable, that the pain of fear itself may contribute to exhaust the sensorial power, even when it produces no muscular action. See Class IV. 2. 2.

5. *Pallor et tremor a timore.* A retrograde action of the capillaries of the skin producing paleness, and a torpor of the muscular fibres of the limbs occasioning trembling, are caused by their reverse associations with the ideas or imaginations of fear; which are now actuated with violent energy, and accompanied with great pain. The cause of these associations is explained in Sect. XVI. 8. 1.

These torpid actions of the capillaries and muscles of the limbs are not caused immediately by the painful

ful sensation of fear; as in that case they would have been increased and not decreased actions, as occurs in anger; where the painful volition increases the actions of the capillaries, exciting a blush and heat of the skin. Whence we may gain some knowledge of what is meant by depressing and exciting passions; the former consisting of ideas attended with pain, which pain occasions no muscular actions, like the pain of cold head-ach; the latter being attended with volitions, and consequent muscular exertions.

That is, the pain of fear, and the pain of anger, are produced by the exertion of certain ideas, or motions of certain nerves of sense; in the former case, the painful sensation of fear produces no muscular actions, yet it exhausts or employs so much sensorial power, that the whole system acts more feebly, or becomes retrograde; but some parts of it more so than others, according to their early associations described in Sect. XVI. 8. 1. hence the tremor of the limbs, palpitation of heart, and even syncope. In anger the painful volition produces violent muscular actions; but if previous to these any deliberation occurs, a flushed countenance sometimes, and a red skin, are produced by this superabundance of volition exerted on the arterial system; but at other times the skin becomes pale, and the legs tremble, from the exhaustion or expenditure of the sensorial power by the painful volitions of anger on the organs of sense, as by the painful sensations of fear above mentioned.

Where

Where the passion of fear exists in a great degree, it exhausts or expends so much sensorial power, either simply by the pain which attends it, or by the violent and perpetual excitement of the terrific imaginations or ideas, that not only a cold and pale skin, but a retrograde motion of the cutaneous absorbents occurs, and a cold sweat appears upon the whole surface of the body, which probably sometimes increases pulmonary absorption; as in Class II. 1. 6. 4. and as in the cold sweats, which attend the paroxysms of humoral asthma. Hence anxiety, which is a continued pain of fear, so universally debilitates the constitution as to occasion a lingering death; which happens much more frequently than is usually supposed; and these victims of continued anxiety are said to die of a broken heart. Other kinds of paleness are described in Class I. 2. 2. 2.

M. M. Opium. Wine. Food. Joy.

6. *Palpitatio cordis a timore.* The palpitation of the heart from fear is owing to the weak action of it, and perhaps sometimes to the retrograde exertion of the ventricles and auricles; because it seems to be affected by its association with the capillaries, the actions of which, with those of the arteries and veins, constitute one great circle of associate motions. Now when the capillaries of the skin become torpid, coldness and paleness succeed; and with these are associated the capillaries of the lungs, whence difficult respiration; and with these the weak and retrograde actions

actions of the heart. At the same time the absorbents of the skin, and of the bladder, and of the intestines, sometimes become retrograde, and regurgitate their contents; as appears by the pale urine in large quantities, which attends hysteric complaints along with this palpitation of the heart; and from the cold sweats, and diarrhœa; all which, as well as the hysteric complaints, are liable to be induced or attended by fear.

When fear has still more violently affected the system, there have been instances where syncope, and sudden death, or a total stoppage of the circulation, have succeeded: in these last cases, the pain of fear has employed or exhausted the whole of the sensorial power, so that not only those muscular fibres generally exerted by volition cease to act, whence the patient falls down; and those, which constitute the organs of sense, whence syncope; but lastly those, which perform the vital motions, become deprived of sensorial power, and death ensues. See Class I. 2. 1. 4. and I. 2. 1. 10. Similar to this in some epileptic fits the patient first suddenly falls down, without even endeavouring to save himself by his hands before the convulsive motions come on. In this case the great exertion of some small part in consequence of great irritation or sensation exhausts the whole sensorial power, which was lodged in the extremities of the locomotive nerves, for a short time, as in syncope; and as soon as these muscles are again supplied, convulsions supervene to relieve the painful sensation. See Class III. 1. 1. 7.

7. *Abortio a timore.* Women miscarry much more frequently from a fright, than from bodily injury. A torpor or retrograde motion of the capillary arteries of the internal uterus is probably the immediate cause of these miscarriages, owing to the association of the actions of those vessels with the capillaries of the skin, which are rendered torpid or retrograde by fear. By this contraction of the uterine arteries, the fine vessels of the placenta, which are inserted into them, are detrued, or otherwise so affected, that the placenta separates at this time from the uterus, and the fetus dies from want of oxygenation. A strong young woman, in the fifth or sixth month of her pregnancy, who has since borne many children, went into her cellar to draw beer; one of the servant boys was hid behind a barrel, and started out to surprize her, believing her to be the maid-servant; she began to flood immediately, and miscarried in a few hours. See Sect. XXXIX. 6. 5. and Class I. 2. 1. 14.

8. *Hysteria a timore.* Some delicate ladies are liable to fall into hysteric fits from sudden fright. The peristaltic motions of the bowels and stomach, and those of the œsophagus, make a part of the great circle of irritative motions with those of the skin, and many other membranes. Hence when the cutaneous vessels become torpid from their reverse sympathy with the painful ideas of fear; these of the bowels, and stomach, and œsophagus, become first torpid by direct sympathy with those of the skin, and then feebly and ineffectually

ineffectually invert the order of their motions, which constitutes a paroxysm of the hysteric disease. See Class I. 3. 1. 10. These hysteric paroxysms are sometimes followed by convulsions, which belong to Class III. as they are exertions to relieve pain; and sometimes by death. See Species 9 of this Genus, and Class I. 2. 1. 4.

Indigestion from fear is to be ascribed in the same manner to the torpor of the stomach, owing to its association with the skin. As in Class IV. 1. 2. 5. IV. 2. 1.

ORDO III.

Retrograde Associate Motions.

GENUS II.

Catenated with Sensitive Motions.

SPECIES.

1. *Nausea idealis.* Nausea from disgustful ideas, as from nauseous stories, or disgustful sights, or smells, or tastes, as well as vomiting from the same causes, consists in the retrograde actions of the lymphatics of the throat, and of the œsophagus, and stomach; which are associated with the disgustful ideas, or sensual motions of sight, or hearing, or smell, or taste; for as these are decreased motions of the lymphatics, or of the œsophagus, or stomach, they cannot immediately be

be excited by the sensorial power of painful sensation, as in that case they ought to be increased motions. So much sensorial power is employed for a time on the disgustful idea, or expended in the production of inactive pain, which attends it, that the other parts of the associated chain of action, of which this disgustful idea is now become a link, are deprived of their accustomed share; and therefore first stop, and then invert their motions. Owing to deficiency of sensorial power, as explained more at large in Sect. XXXV. 1. 3.

2. *Nausea a conceptu.* The nausea, which pregnant women are so subject to during the first part of gestation, is owing to the reverse sympathy between the uterus and stomach, so that the increased action of the former, excited by the stimulus of the growing embryo, which I believe is sometimes attended with sensation, produces decreased actions of the latter with the disagreeable sensation of sickness with indigestion and consequent acidity. When the fetus acquires so much muscular power as to move its limbs, or to turn itself, which is called quickening, this sickness of pregnancy generally ceases.

M. M. Calcined magnesia. Rhubarb. Half a grain of opium twice a day. Recumbent posture on a sofa.

3. *Vomitio vertiginosa.* Sea-sickness, the irritative motions of vision, by which we balance ourselves, and preserve our perpendicularity, are disturbed by the indistinctness of their objects: which is either owing

to the similarity of them, or to their distance, or to their apparent or unusual motions. Hence these irritative motions of vision are exerted with greater energy, and are in consequence attended with sensation; which at first is agreeable, as when children swing on a rope; afterwards the irritative motions of the stomach, and of the absorbent vessels, which open their mouths into it, become inverted by their associations with them by reverse sympathy.

For the action of vomiting, as well as the disagreeable sensation of sickness, are shewn to be occasioned by defect of the sensorial power; which in this case is owing to the greater expenditure of it by the sense of vision. On the same account the vomiting, which attends the passage of a stone through the ureter, or from an inflammation of the bowels, or in the commencement of some fevers, is caused by the increased expenditure of the sensorial power by the too great action of some links of the associations of irritative motions; and there being in consequence a deficiency of the quantity required for other links of this great catenation.

It must be observed, that the expenditure of sensorial power by the retinas of the eyes is very great; which may be estimated by the perpetual use of those organs during our waking hours, and during most of our sleeping ones; and by the large diameters of the two optic nerves, which are nearly the size of a quill, or equal to some of the principal nerves, which serve the limbs.

4. *Vomitio a calculo in uretere.* The action of vomiting in consequence of the increased or decreased actions of the ureter, when a stone lodges in it. The natural actions of the stomach, which consist of motions subject to intermitted irritations from the fluids, which pass through it, are associated with those of the ureter; and become torpid, and consequently retrograde, by intervals, when the actions of the ureter becomes torpid owing to previous great stimulus from the stone it contains; as appears from the vomiting existing when the pain is least. When the motions of the ureter are thus lessened, the sensorial power of association, which ought to actuate the stomach along with the sensorial power of irritation, ceases to be excited into action; and in consequence the actions of the stomach become less energetic, and in consequence retrograde.

For as vomiting is a decreased action of the stomach, as explained in Sect. XXXV. 1. 3. it cannot be supposed to be produced by the pain of gravel in the ureter alone, as it should then be an increased action, not a decreased one.

The perpetual vomiting in ileus is caused in like manner by the defective excitement of the sensorial power of association by the bowel, which is torpid during the intervals of pain; and the stomach sympathizes with it. See Enteritis, Class II. 1. 2. 11. Does this symptom of vomiting indicate, whether the disease be above or below the valve of the colon? Does not the softer pulse in some kinds of enteritis

depend on the sympathy of the heart and arteries with the sickness of the stomach? See Ileus and Cholera.

Hence this sickness, as well as the sickness in some fevers, cannot be esteemed an effort of nature to dislodge any offensive material; but like the sea-sickness described above, and in Sect. XX. 4. is the consequence of the associations of irritative or sensitive motions. See Class I. 1. 3. 9.

5. *Vomitio ab insultu paralytico.* Paralytic affections generally commence with vomiting, the same frequently happens from a violent blow with a stick on the head; this curious connection of the brain and stomach has not been explained; as it resembles the sickness in consequence of vertigo at sea, it would seem to arise from a similar cause, viz. from disturbed irritative or sensitive associations.

6. *Vomitio a titillatione faucium.* If the throat be slightly tickled with a feather, a nausea is produced, that is, an inverted action of the mouths of the lymphatics of the fauces, and by direct sympathy an inverted action of the stomach ensues. As these parts have frequently been stimulated at the same time into pleasurable action by the deglutition of our daily aliment, their actions become strongly associated. And as all the food, we swallow, is either moist originally, or mixed with our moist saliva in the mouth; a feather, which is originally dry, and which in some measure repels the moist saliva, is disagreeable to the touch

touch of the fauces; at the same time this nausea and vomiting cannot be caused by the disagreeable sensation simply, as then they ought to have been increased exertions, and not decreased ones, as shewn in Section XXXV. 1. 3. But the mouths of the lymphatics of the fauces are stimulated by the dry feather into too great action for a time, and become retrograde afterwards by the debility consequent to too great previous stimulus.

7. *Vomitio cute sympathetica.* Vomiting is successfully stopped by the application of a blister on the back in some fevers, where the extremities are cold, and the skin pale. It was stopped by Sydenham by producing a sweat on the skin by covering the head with the bed-clothes. See Class IV. 1. 1. 3. and Suppl. I. 11. 6.

ORDO III.

Retrograde Associate Motions.

GENUS III.

Catenated with Voluntary Motions.

SPECIES.

1. *Ruminatio.* In the rumination of horned cattle the food is brought up from the first stomach by the retrograde motions of the stomach and œsophagus, which are catenated with the voluntary motions of the abdominal muscles.

2. *Vomitio voluntaria.* Voluntary vomiting. Some human subjects have been said to have obtained this power of voluntary action over the retrograde motions of the stomach and œsophagus, and thus to have been able to empty their stomach at pleasure. See Sect. XXV. 6. This voluntary act of emptying the stomach is possessed by some birds, as the pigeon; who has an organ for secreting milk in its stomach, as Mr. Hunter observed; and softens the food for its young by previously swallowing it; and afterwards putting its bill into theirs returns it into their mouths. See Sect. XXXIX. 4. 8. The pelicans use a stomach, or throat bag, for the purpose of bringing the fish, which they catch in the sea to shore, and then eject them, and eat them at their leisure. See Sect. XVI. 11. And I am well informed of a bitch, who having puppies in a stable at a distance from the house, swallowed the

the flesh-meat, which was given her, in large pieces, and carrying it immediately to her whelps, brought it up out of her stomach, and laid it down before them.

3. *Eructatio voluntaria*. Voluntary eructation. Some, who have weak digestions, and thence have frequently been induced to eruct the quantity of air discharged from the fermenting aliment in their stomachs, have gradually obtained a power of voluntary eructation, and have been able thus to bring up hog-heads of air from their stomachs, whenever they pleased. This great quantity of air is to be ascribed to the increase of the fermentation of the aliment by drawing off the gas as soon as it is produced. See Sect. XXIII. 4.

ORDO III.

Retrograde Associate Motions.

GENUS IV.

Catenated with External Influences.

SPECIES.

1. *Catarrhus periodicus*. Periodical catarrh is not a very uncommon disease; there is a great discharge of a thin saline mucous material from the membranes of the nostrils, and probably from the maxillary and frontal sinuses, which recur once a day at exact solar periods; unless it be disturbed by the exhibition of opium; and resembles the periodic cough mentioned below. See Class I. 3. 2. 1. It is probably owing to the retrograde action of the lymphatics of the membranes affected, and produced immediately by solar influence.

2. *Tussis periodica*. Periodic cough, called nervous cough, and tussis ferina. It seems to arise from a periodic retrograde action of the lymphatics of the membrane, which lines the air-cells of the lungs. And the action of coughing, which is violent for an hour or longer, is probably excited by the stimulus of the thin fluid thus produced, as well as by the disagreeable sensation attending membranous inactivity; and resembles periodic catarrh not only in its situation on a mucous membrane, but in the discharge of a thin fluid. As it is partly restrainable, it does not come under

under the name of convulsion; and as it is not attended with difficult respiration, it cannot be called asthma; it is cured by very large doses of opium, see a case and cure in Sect. XXXVI. 3. 9. see Class IV. 2. 4. 6. and seems immediately to be induced by solar influence.

3. *Hysteria a frigore.* Hysterical paroxysms are occasioned by whatever suddenly debilitates the system, as fear, or cold, and perhaps sometimes by external moisture of the air, as all delicate people have their days of greater or less debility, see Class IV. 3. 1. 8.

4. *Nausea pluvialis.* Sickness at the commencement of a rainy season is very common among dogs, who assist themselves by eating the agrostis canina, or dog's grass, and thus empty their stomachs. The same occurs with less frequency to cats, who make use of the same expedient. See Sect. XVI. 11. I have known one person, who from his early years has always been sick at the beginning of wet weather, and still continues so. Is this owing to a sympathy of the mucous membrane of the stomach with the mechanical relaxation of the external cuticle by a moister atmosphere, as is seen in the corrugated cuticle of the hands of washing-women? or does it sympathize with the mucous membrane of the lungs, which must be affected along with the mucus on its surface by the respiration of a moister atmosphere?



S U P P L E M E N T

TO

CLASS IV.

SYMPATHETIC THEORY OF FEVER.

AS fever consists in the increase or diminution of direct or reverse associated motions, whatever may have been the remote cause of them, it properly belongs to the fourth class of diseases; and is introduced at the end of the class, that its great difficulties might receive elucidation from the preceding parts of it. These I shall endeavour to enumerate under the following heads, trusting that the candid reader will discover in these rudiments of the theory of fever a nascent embryo, an infant Hercules, which Time may rear to maturity, and render serviceable to mankind.

- I. Simple fever of two kinds.
- II. Compound fever.
- III. Termination of the cold fit.
- IV. Return of the cold fit.
- V. Sensation excited in fever.
- VI. Circles of associated motions.
- VII. Alternations of cold and hot fits.
- VIII. Orgasms

- VIII. Orgasm of the capillaries.
- IX. Torpor of the lungs.
- X. Torpor of the brain.
- XI. Torpor of the heart and arteries.
- XII. Torpor of the stomach and intestines.
- XIII. Cause of continued fever explained.
- XIV. Termination of continued fever.
- XV. Inflammation excited in fever.
- XVI. Recapitulation.

I. *Simple Fever.*

1. When a small part of the cutaneous capillaries with their mucous or perspirative glands are for a short time exposed to a colder medium, as when the hands are immersed in iced water for a minute, these capillary vessels and their glands become torpid or quiescent, owing to the eduction of the stimulus of heat. The skin then becomes pale, because no blood passes through the external capillaries; and appears shrunk, because their sides are collapsed from inactivity, not contracted by spasm; the roots of the hair are left prominent from the seceding or subsiding of the skin around them; and the pain of coldness is produced.

In this situation, if the usual degree of warmth be applied, these vessels regain their activity; and having now become more irritable from an accumulation of the sensorial power of irritation during their quiescence, a greater exertion of them follows, with an increased glow of the skin, and another kind of pain, which

which is called the hot-ach; but no fever, properly so called, is yet produced; as this effect is not universal, nor permanent, nor recurrent.

2. If a greater part of the cutaneous capillaries with their mucous and perspirative glands be exposed for a longer time to cold, the torpor or quiescence becomes extended by direct sympathy to the heart and arteries; which is known by the weakness, and consequent frequency of the pulse in cold fits of fever.

This requires to be further explained. The movements of the heart and arteries, and the whole of the circulatory vessels, are in general excited into action by the two sensorial powers of irritation, and of association. The former is excited by stimulus, the latter by the previous actions of a part of the vital circle of motions. In the above situation the capillaries act weakly from defect of irritation, which is caused by deficient stimulus of heat; but the heart and arteries act weakly from defect of association, which is owing to the weak action of the capillaries; which does not now excite the sensorial power of association into action with sufficient energy.

After a time, either by the application of warmth, or by the increase of their irritability owing to the accumulation of the sensorial power of irritation during their previous quiescence, the capillary vessels and glands act with greater energy than natural; whence the red colour and heat of the skin. The heart

heart and arteries acquire a greater strength of pulsation, and continue the frequency of it, owing to the accumulation of the sensorial power of association during their previous torpor, and their consequent greater associability; which is now also more strongly excited by the increased actions of the capillaries. And thus a fit of simple fever is produced, which is termed *Febris irritativa*; and consists of a torpor of the cutaneous capillaries with their mucous and perspirative glands, accompanied with a torpor of the heart and arteries; and afterwards of an increased action of all these vessels, by what is termed direct sympathy.

This fever, with strong pulse without inflammation, or *febris irritativa*, described in Class I. 1. 1. 1. is frequently seen in vernal intermittents, as the orgasm of the heart and arteries is then occasioned by their previous state of torpor; but more rarely I believe exists in the type of continued fever, except there be an evident remission, or approximation to a cold fit; at which time a new accumulation of the sensorial power of association is produced; which afterwards actuates the heart and arteries with unnatural vigour; or unless there be some stimulus perpetually acting on the system, so as to induce an increased secretion of sensorial power in the brain, as occurs in slight degrees of intoxication. Since without one or other of these circumstances in continued fevers without inflammation, that is, without the additional sensorial power of sensation being introduced, it seems difficult

to account for the production of so great a quantity of sensorial power, as must be necessary to give perpetual increase of action to the whole sanguiferous system.

3. On the contrary, while the cutaneous capillaries with their mucous and perspirative glands acquire an increased irritability, as above, by the accumulation of that sensorial power during their previous quiescence, and thus constitute the hot fit of fever; if the heart and arteries do not acquire any increase of associability, but continue in their state of torpor, another kind of simple fever is produced; which is generally of the continued kind, and is termed *Febris inirritativa*; which consists of a previous torpor of the capillaries of the skin, and of the heart and arteries by direct sympathy with them; and afterwards of an orgasm or increased action of the capillaries of the skin, with a decreased action, or continued torpor, of the heart and arteries by reverse sympathy with them. This orgasm of the cutaneous capillaries, which appears by the blush and heat of the skin, is at first owing to the accumulation of the sensorial power of irritation during their previous torpid state, as in the *febris irritata* above described; but which is afterwards supported or continued by the reverse sympathy of these capillaries with the torpid state of the heart and arteries, as will be further explained in article 8 of this Supplement.

4. The renovated activity of the capillaries commences as soon or sooner than that of the heart and arteries after the cold fit of irritative fever; and is not owing to their being forced open by the blood being impelled into them mechanically, by the renovated action of the heart and arteries; for these capillaries of the skin have greater mobility than the heart and arteries, as appears in the sudden blush of shame; which may be owing to their being more liable to perpetual varieties of activity from their exposure to the vicissitudes of atmospheric heat. And because in inirritative fevers, or those with arterial debility, the capillaries acquire increased strength, as is evinced by the heat of the skin, while the pulsations of the heart and arteries remain feeble.

5. It was said above, that the cutaneous capillaries, when they were rendered torpid by exposure to cold, either recovered their activity by the reapplication of external warmth; or by their increased irritability, which is caused by the accumulation of that sensorial power during their quiescence. An example of the former of these may be seen on emerging from a very cold bath; which produces a fit of simple fever; the cold fit, and consequent hot fit, of which may be prolonged by continuing in the bath; which has indeed proved fatal to some weak and delicate people, and to others after having been much exhausted by heat and exercise. See Sect. XXXII. 3. 2. An example of the latter may be taken from going into a
bath

bath of about eighty degrees of heat, as into the bath at Buxton, where the bather first feels a chill, and after a minute becomes warm, though he remains in the same medium, owing to the increase of irritability from the accumulation of that sensorial power during the short time, which the chillness continued.

6. Hence simple fevers are of two kinds; first; the febris irritativa, or fever with strong pulse; which consists of a previous torpor of the heart, arteries, and capillaries, and a succeeding orgasm of those vessels. Secondly, the febris inirritativa, or fever with weak pulse, which consists of a previous torpor of the heart, arteries, and capillaries; and of a succeeding orgasm of the capillaries, the torpor of the heart and arteries continuing. But as the frequency of the pulse occurs both in the state of torpor, and in that of orgasm, of the heart and arteries; this constitutes a criterion to distinguish fever from other diseases, which are owing to the torpor of some parts of the system, as paresis, and hemicrania.

7. The reader will please to observe, that where the cutaneous or pulmonary capillaries are mentioned, their mucous and perspirative glands are to be understood as included; but that the absorbents belonging to those systems of vessels, and the commencement of the veins, are not always included; as these are liable to torpor separately, as in anasarca, and petechiæ; or

to orgasm, or increased action, as in the exhibition of strong emetics, or in the application of vinegar to the lips; yet he will also please to observe, that an increased or decreased action of these absorbents and veins generally occurs along with that of the capillaries, as appears by the dry skin in hot fits of fever; and from there being generally at the same time no accumulation of venous blood in the cutaneous vessels, which would appear by its purple colour.

II. *Compound Fever.*

1. When other parts of the system sympathize with this torpor and orgasm of the cutaneous capillaries, and of the heart and arteries; the fever-fit becomes more complicated and dangerous; and this in proportion to the number and consequence of such affected parts. Thus if the lungs become affected, as in going into very cold water, a shortness of breath occurs; which is owing to the collapse or inactivity (not to the active contraction, or spasm), of the pulmonary capillaries; which, as the lungs are not sensible to cold, are not subject to painful sensation, and consequent shuddering, like the skin. In this case after a time the pulmonary capillaries, like the cutaneous ones, act with increased energy; the breathing, which was before quick, and the air thrown out at each respiration in less quantity, and cool to the back of the hand opposed to it, now becomes large in quantity, and warmer than natural; which however is not accompanied with the sensation of heat in the mem-

brane, which lines the air-vessels of the lungs, as in the skin.

2. One consequence of this increased heat of the breath is the increased evaporation of the mucus on the tongue and nostrils. A viscid material is secreted by these membranes to preserve them moist and supple, for the purposes of the senses of taste and of smell, which are extended beneath their surfaces; this viscid mucus, when the aqueous part of it is evaporated by the increased heat of the respired air, or is absorbed by the too great action of the mucous absorbents, adheres closely on those membranes, and is not without difficulty to be separated from them. This dryness of the tongue and nostrils is a circumstance therefore worthy to be attended to; as it shews the increased action of the pulmonary capillaries, and the consequent increased heat of the expired air; and may thus indicate, when colder air should be admitted to the patient. See Class I. 1. 3. 1. The middle part of the tongue becomes dry sooner, and recovers its moisture later, than the edges of it; because the currents of respired air pass most over the middle part of it. This however is not the case, when the dryness of the tongue is owing only to the increased mucous absorption. When however a frequent cough attends pulmonary inflammation, the edges of the tongue are liable to be as much furred as the middle of it; as during the action of coughing the middle of the tongue is depressed, so as to form half a cylinder, to give a greater aperture for the emission of air from the

larynx; and the edges of it become thus as much exposed to the currents of air, as the middle parts of it.

3. When the internal capillaries or glands sympathize with the cutaneous capillaries; or when any of them are previously affected with torpor, and the external or cutaneous capillaries are affected secondarily; other symptoms are produced, which render the paroxysms of fever still more complicate. Thus if the spleen or pancreas are primarily or secondarily affected, so as to be rendered torpid or quiescent, they are liable to become enlarged, and to remain so even after the extinction of the fever-fit. These in some intermittent fevers are perceptible to the hand, and are called ague-cakes; their tumour seems to be owing to the permanent torpor of the absorbent system, the fecerning vessels continuing to act some time afterwards. If the secretory vessels of the liver are affected first with torpor, and afterwards with orgasm, a greater secretion of bile is produced, which sometimes causes a diarrhœa. If a torpor of the kidneys, and of the absorbents of the bladder occurs, either primarily, or by sympathy with the cutaneous capillaries, the urine is in small quantity and pale, as explained in Class I. 2. 2. 5.; and if these secretory vessels of the kidneys, and the absorbents of the bladder act more strongly than natural afterwards by their increased irritability or associability, the urine becomes in larger quantity, and deeper coloured, or deposits its earthy parts,

parts, as in Class I. 1. 2. 4. which has been esteemed a favourable circumstance. But if the urine be in small quantity, and no sediment appears in it, after the hot fit is over; it shews, that the secreting vessels of the kidneys and the absorbent vessels of the bladder have not regained the whole of their activity, and thence indicates a greater tendency to a return of the cold fit.

4. When the stomach is affected with torpor either primarily; or secondarily by its sympathy with the cutaneous capillaries; or with some internal viscus; sickness occurs, with a total want of appetite to any thing solid; vomiting then supervenes, which may often be relieved by a blister on the skin, if the skin be cool and pale; but not if it be hot and flushed. The intestines cease to perform their office of absorption from a similar torpor; and a diarrhœa supervenes owing to the acrimony of their putrid, or of their acid contents. The loose undigested or fetid stools indicate the inability of the intestines to perform their proper office; as the mucus and gastric acid, which are vomited up, does that of the stomach; this torpor of the stomach is liable to continue after the cold paroxysm ceases, and to convert intermittent fevers into continued ones by its direct sympathy with the heart and arteries. See article 10 of this Supplement.

5. If the meninges of the brain sympathize with other torpid parts, or are primarily affected, delirium, stupor, and perhaps hydrocephalus internus occur, see Class II. 1. 7. 1. and I. 2. 5. 10; and sometimes the pulse becomes slow, producing paresis instead of fever. But if the membranes, which cover the muscles about the head, or of the pericranium, become torpid by their sympathy with other torpid parts, or are primarily affected, a head-ach supervenes; which however generally ceases with the cold paroxysm of fever. For as when the sensorial power of volition is exhausted by labour, a few hours, or half a solar day, passed in sleep recruits the system by accumulation of this sensorial power; so when the sensorial power of irritation is exhausted, one or two solar or lunar days of rest or quiescence of the affected part will generally restore its action by accumulation of irritability, and consequent increase of association, as in hemisrania, Class IV. 2. 2. 8. But when the heart and arteries become torpid, either primarily, or by their sympathy with the stomach, this accumulation of the sensorial power of irritation can take place but slowly; *as to rest is death!* This explains the cause of the duration of fevers with weak pulse, which continue a quarter, or half, or three quarters, or a whole lunation, or still longer, before sufficient accumulation of irritability can be produced to restore their natural strength of action.

6. If the absorbent vessels, which are spread around the neck of the bladder, become torpid by their direct sympathy with the absorbents of the skin in cold fits of fever; the urine, which is poured into the bladder in but small quantity from the torpid kidneys, has nevertheless none of its aqueous saline part reabsorbed; and this saline part stimulates the bladder to empty itself frequently, though the urine is in small quantity. Which is not therefore owing to any supposed spasm of the bladder, for the action of it in excluding the urine is weak, and as much controllable by the will as in ordinary micturition.

7. If the beginnings or absorbent mouths of the venous system remain torpid, petechiæ or vibices are produced in fevers, similar to those which are seen in scurvy without fever. If the skin was frequently moistened for an hour, and at the same time exposed to the common air, or to oxygen gas, it might contribute to turn the black colour of these points of extravasated blood into scarlet, and thus by increasing its stimulus facilitate its reabsorption? For oxygen gas penetrates moist animal membranes though not dry ones, as in the lungs during respiration.

8. When the sensorial power of sensation is introduced into the arterial system, other kinds of compound fevers are produced, which will be spoken of in their place.

III. *Termination of the cold Fit.*

1. If all the parts, which were affected with torpor, regain their irritability, and associability, the cold paroxysm of fever ceases; but as some of the parts affected were previously accustomed to incessant action, as the heart and arteries, and others only to intermitted action, as the stomach and intestines; and as those, which are subjected during health to perpetual action, accumulate sensorial power faster, when their motions are impeded, than those which are subjected to intermitted action; it happens, that some of the parts, which were affected with torpor during the cold fit, recover their irritability or associability sooner than others, and more perfectly, or acquire a greater quantity of them than natural; as appears by the partial heat and flushings previous to the general hot fit.

Hence if all the parts, which were previously torpid, regain their due degree of irritability, or of associability, the disease is removed, and health restored. If some or all of them acquire more than their natural degree of these sensorial powers; increased actions, and consequent increased secretions, and greater heat occur, and constitute the hot fit of fever. If after this hot fit of fever all the parts, which had acquired too great irritability, or associability, regain their natural degree of it; the disease is removed, and health restored. But if some of these parts do not regain their natural degree of these sensorial powers, the actions

actions of those parts remain imperfect, and are more or less injurious to the system, according to the importance of their functions.

2. Thus if a torpor of the heart and arteries remains; the quick pulse without strength, which begins in the cold fit, persists; and a continued fever is produced. If the torpor of the stomach and intestines remains, which are known by sickness and undigested stools, the fever is liable to be of considerable length and danger; the same if the kidneys and absorbent system retain some degree of torpor, as is shewn by the pale urine in not unusual quantity. If part of the absorbent system remains torpid, as the absorbent vessels of the spleen, a tumour of that viscus occurs, which may be felt by the hand; the same sometimes happens to the liver; and these from their tendency to more complete torpor are afterwards liable to give occasion to a return of the cold fit. If the cellular absorbents do not completely recover their activity, a pale and bloated countenance with swelled legs mark their want of action.

3. As the termination of the cold fit is owing to the accumulation of the sensorial power of irritation and of association during the previous quiescence of the system; and as those parts, which are in perpetual action during health, are more subject to this accumulation during their torpor, or quiescence; one should have imagined, that the heart and arteries would ac-

quire this accumulation of sensorial power sooner or in greater degree than other parts. This indeed so happens, where the pulse is previously strong, as in febris irritativa; or where another sensorial power, as that of sensation, is exerted on the arterial system, as in inflammations. The heart and arteries in these cases soon recover from their torpor, and are exerted with great violence.

Many other parts of the system subject to perpetual motion in health may rest for a time without much inconvenience to the whole; as when the fingers of some people become cold and pale; and during this complete rest great accumulation of irritability may be produced. But where the heart and arteries are previously feeble, they cannot much diminish their actions, and certainly cannot rest entirely, for that would be death; and therefore in this case their accumulation of the sensorial power of irritation or of association is slowly produced, and a long fever supervenes in consequence; or sudden death, as frequently happens, terminates the cold fit.

Whence it appears, that in fevers with weak pulse, if the action of the heart, arteries, and capillaries could be diminished, or stopped for a short time without occasioning the death of the patient, as happens in cold bathing, or to persons apparently drowned, that a great accumulation of the sensorial powers of irritation or of association might soon be produced, and the pulse become stronger, and consequently slower, and the fever cease. Hence cold ablu-
tion

may

may be of service in fevers with weak pulse, by preventing the expenditure and producing accumulation of the sensorial power of irritation or association. Stupor may be useful on the same account. Could a centrifugal swing be serviceable for this purpose, either by placing the head or the feet in the outward part of the circle, as described in Art. 15. 7. of this Supplement?

IV. *Return of the cold Fit.*

1. If the increased action of the cutaneous and pulmonary capillaries, and of the heart and arteries, in febris irritativa continues long and with violence, a proportional expenditure or exhaustion of sensorial power occurs; which by its tendency to induce torpor of some part, or of the whole, brings on a return of the cold fit.

2. Another cause which contributes to induce torpor of the whole system by the sympathy of its parts with each other, is the remaining torpor of some viscus; which after the last cold paroxysm had not recovered itself, as of the spleen, liver, kidneys, or of the stomach and intestines, or absorbent vessels, as above mentioned.

3. Other causes are the deficiency of the natural stimuli, as hunger, thirst, and want of fresh air. Other causes are great fatigue, want of rest, fear, grief, or anxiety of mind. And lastly, the influence
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of external ethereal fluids, as the defect of external heat, and of solar or lunar gravitation. Of the latter the return of the paroxysms of the continued fevers about six o'clock in the evening, when the solar gravitation is the least, affords an example of the influence of it; and the usual periods of intermittents, whether quotidian, tertian, or quartan, which so regularly obey solar or lunar days, afford instances of the influence of those luminaries on these kinds of fevers.

4. If the tendency to torpor of some viscus is considerable, this will be increased at the time, when the terrene gravitation is greatest, as explained in the introduction to Class IV. 2. 4. and may either produce a cold paroxysm of quotidian fever; or it may not yet be sufficient in quantity for that purpose, but may nevertheless become greater, and continue so till the next period of the greatest terrene gravitation, and may then either produce a paroxysm of tertian fever; or may still become greater, and continue so till the next period of greatest terrene gravitation, and then produce a paroxysm of quartan ague. And lastly, the periodical times of these paroxysms may exceed, or fall short of, the time of greatest diurnal terrene gravitation according to the time of day, or period of the moon, in which the first fit began; that is, whether the diurnal terrene gravitation was then in an increasing or decreasing state.

V. *Sensation excited in Fever.*

1. A curious observation is related by Dr. Fordyce in his *Tract on Simple fever*, page 168. He asserts, that those people, who have been confined some time in a very warm atmosphere, as of 120 or 130 degrees of heat, do not feel cold, nor are subject to paleness of their skins, on coming into a temperature of 30 or 40 degrees; which would produce great paleness and painful sensation of coldness in those, who had been some time confined in an atmosphere of only 86 or 90 degrees. Analagous to this, an observing friend of mine assured me, that once having sat up to a very late hour with three or four very ingenious and humorous companions, and drank a considerable quantity of wine; both contrary to his usual habits of life; and being obliged to rise early, and to ride a long journey on the next day; he expected to have found himself weak and soon fatigued; but on the contrary he performed his journey with unusual ease and alacrity; and frequently laughed, as he rode, at the wit of the preceding evening. In both these cases a degree of pain or pleasure actuated the system; and thus a sensorial power, that of sensation, was superadded to that of irritation, or volition. See Sect. XXXIV. 2. 6.

2. Similar to this, when the energetic exertions of some parts of the system in the hot fit of fever arise to a certain excess, a degree of sensation is produced;

as of heat, which particularly increases the actions of the cutaneous vessels, which are more liable to be excited by this stimulus. When this additional sensorial power of sensation exists to a greater degree, the pulse, which was before full, now becomes hard, owing to the inflammation of the vasa vaforum, or coats of the arteries. In these cases, whether there is any topical inflammation or not, the fever ceases to intermit; but nevertheless there are daily remissions and exacerbations of it; which recur for the most part about six in the evening, when the solar gravitation is the least, as mentioned in Sect. XXXVI. 3. 7.

3. Thus the introduction of another sensorial power, that of sensation, converts an intermittent fever into a continued one. If it be attended with strong pulse, it is termed febris sensitiva irritata, or pyrexia, or inflammation; if with a weak pulse, it is termed febris sensitiva inirritata, or typhus gravior, or malignant fever. The seat of the inflammation is in the glandular or capillary system, as it consists in the secretion of new fluids, or new fibres, which form new vessels, as they harden, like the silk of the silk-worm. See Art. 15. of this Supplement.

VI. *Circles of irritative Associate Motions.*

1. There are some associate motions, which are perpetually proceeding in our waking hours, and are catenated by their first link, or in some subsequent parts of the chain, with the stimuli or the influence
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of external things; which we shall here enumerate, as they contribute to the knowledge of fever. Of these are the irritative ideas, or sensual motions of the organs of sense, and the muscular motions associated with them; which, when the chain is disturbed or interrupted, excite the sensorial power of sensation, and proceed in confusion. Thus if the irritative ideas of sight are disturbed, the paralytic motions of objects, which in general are unperceived, become sensible to us; and the locomotive muscles associated with them, which ought to preserve the body erect, stagger from this decrease or interruption of the sensorial power of association; and vertigo is produced.

When the irritative sensual motions, or ideas, belonging to one sense are increased or diminished, the irritative sensual motions, or ideas, of the other senses are liable to become disturbed by their general catenations; whence occur noises in the ears, bad tastes in the mouth, bad odours, and numbness or tingling of the limbs, as a greater or less number of senses are affected. These constitute concomitant circles of disturbed irritative ideas; or make a part of the great circle of irritative ideas, or motions of the organs of sense; and when thus disturbed occasion many kinds of hallucination of our other senses, or attend on the vertigo of vision.

2. Another great circle of irritative associated motions consists of those of the alimentary canal; which are catenated with stimuli or with influences external

to the system, but continue to be exerted in our sleeping as well as in our waking hours. When these associations of motion are disturbed by the too great or too small stimulus of the food taken into the stomach, or by the too great excess or deprivation of heat, or by indigestible substances, or by torpor or orgasm occasioned by their association with other parts, various diseases are induced under the names of apepsia, hypochondriasis, hysteria, diarrhoea, cholera, ileus, nephritis, fever.

3. A third circle of irritative associate motions consists of those of the absorbent system; which may be divided into two, the lacteals, and the lymphatics. When the stomach and intestines are recently filled with food and fluid, the lacteal system is stimulated into great action; at the same time the cellular, cutaneous, and pulmonary lymphatics act with less energy; because less fluid is then wanted from those branches, and because more sensorial power is expended by the lacteal branch. On this account these two systems of absorbents are liable to act by reverse sympathy; hence pale urine is made after a full dinner, as less of the aqueous part of it is imbibed by the urinary lymphatics; and hence the water in anasarca of the lungs and limbs is speedily absorbed, when the actions of the lacteals of the stomach or intestines are weakened or inverted by the exhibition of those drugs, which produce nausea, or by violent vomiting, or violent cathartics.

Hence

Hence in diabetes the lacteal system acts strongly, at the same time that the urinary lymphatics invert their motions, and transmit the chyle into the bladder; and in diarrhœa from crapula, or too great a quantity of food and fluid taken at a time, the lacteals act strongly, and absorb chyle or fluids from the stomach and upper intestines; while the lymphatics of the lower intestines revert their motions, and transmit this over-repletion into the lower intestines, and thus produce diarrhœa; which accounts for the speedy operation of some cathartic drugs, when much fluid is taken along with them.

4. Other circles of irritative associate motions of great importance are those of the discerning system; of these are the motions of the larger congeries of glands, which form the liver, spleen, pancreas, gastric glands, kidneys, salivary glands, and many others; some of which act by direct and others by reverse sympathy with each other. Thus when the gastric glands act most powerfully, as when the stomach is filled with food, the kidneys act with less energy; as is shewn by the small secretion of urine for the first hour or two after dinner; which reverse sympathy is occasioned by the greater expenditure of sensorial power on the gastric glands, and to the newly absorbed fluids not yet being sufficiently animalized, or otherwise prepared, to stimulate the secretory vessels of the kidneys.

But

But those very extensive glands, which secrete the perspirable matter of the skin and lungs, with the mucus, which lubricates all the internal cells and cavities of the body, claim our particular attention. These glands, as well as all the others, proceed from the capillary vessels, which unite the arteries with the veins, and are not properly a part of them; the mucous and perspirable glands, which arise from the cutaneous and pulmonary capillaries, are associated by direct sympathy; as appears from immersion in the cold bath, which is therefore attended with a temporary difficult respiration; while those from the capillaries of the stomach and heart and arteries are more generally associated by reverse sympathy with those of the cutaneous capillaries; as appears in fevers with weak pulse and indigestion, and at the same time with a hot and dry skin.

The disturbed actions of this circle of the associate motions of the secreting system, when the sensorial power of sensation is added to that of irritation, frequently produces inflammation, which consists in the secretion of new fluids or new vessels. Nevertheless, if these disturbed actions be of the torpid kind, the pain, which attends them, is seldom productive of inflammation, as in hemicrania; but is liable to excite voluntary actions, and thus to expend much sensorial power, as in the shuddering in cold fits of fever, or in convulsions; or lastly, the pain itself, which attends torpid actions, is liable to expend or exhaust much sensorial power without producing any increased ac-

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tions;

tions; whence the low pulse, and cold extremities, which usually attend hemicrania; and hence when inert, or inactive sensation attends one link of associated action, the succeeding link is generally rendered torpid, as a coldness of the cheek attends tooth-ach.

5. A fifth important circle of irritative motions is that of the sanguiferous system, in which the capillary vessels are to be included, which unite the arterial and venous systems, both pulmonary and aortal. The disturbed action of this system of the heart and arteries, and capillaries, constitute simple fever; to which may be added, that the fecerning and absorbent vessels appending to the capillaries, and the bibulous mouths of the veins, are in some measure at the same time generally affected.

6. Now, though the links of each of these circles of irritative motions are more strictly associated together, yet are they in greater or less degree associated or catenated with each other by direct or reverse sympathy. Thus the sickness, or inverted irritative motions of the stomach, are associated or catenated with the disturbed irritative ideas, or sensual motions, in vertigo; as in sea-sickness. This sickness of the stomach is also associated or catenated with the torpor of the heart and arteries by direct sympathy, and with the capillaries and absorbents by reverse sympathy; and are thus all of them liable occasionally to be disturbed, when one of them is diseased; and constitute the great variety of the kinds or symptoms of fevers.

VII. *Alternation of the cold and hot Fits.*

I. When any cause occurs, which diminishes to a certain degree the supply of sensorial power in respect to the whole system; as suppose a temporary in exertion of the brain; what happens? First, those motions are exerted with less energy, which are not immediately necessary to life, as the locomotive muscles; and those ideas, which are generally excited by volition; at the same time this deficiency of voluntary motion is different from that which occurs in sleep; as in that the movements of the arterial system are increased in energy though not in frequency. Next, the motions of the alimentary canal become performed with less energy, or cease altogether; and a total want of appetite to solid food occurs, or sickness, or a diarrhoea occasioned by the indigested aliment. Then the absorbent vessels cease to act with their due energy; whence thirst, and pale urine, though in small quantities. Fourthly, the fecerning vessels become affected by the general diminution of sensorial power; whence all the secreted fluids are produced in less quantity. And lastly, the sanguiferous canals feel the general torpor; the pulsations of the heart and arteries become feeble, and consequently quick; and the capillaries of the skin become inactive, acquire less blood from the arteries, and are consequently paler and shrunk.

In this last circumstance of the torpor of the sanguiferous system consists inirritative fever; as all the others are rather accidental or concomitant symptoms,
and

and not essential ones; as fewer or more of them may be present, or may exist with a greater or less degree of inactivity.

2. Now as the capillaries of the skin are exposed to greater varieties of heat and cold, than the heart and arteries, they are supposed to be more mobile; that is, more susceptible of torpor or exertion, or of inflammation, by external stimuli or influences, than the other parts of the sanguiferous system; and as the skin is more sensible to the presence of heat, than the internal parts of the body, the commencement of the cold paroxysms of fever generally either first exists in, or is first perceived by, the coldness and paleness of the skin; and the commencement of the hot fits by the heat and redness of it.

3. The accumulation of sensorial power occurs in these organs soonest, and in greatest quantity, during their quiescence, which were most perpetually in action during health; hence those parts of the system soonest recover from torpor in intermittent fever, and soonest fall into the contrary extreme of increased activity; as the sanguiferous system of the heart and arteries and capillaries. But of these the capillaries seem first to acquire a renovation of their action, as the heat of the skin becomes first renewed, as well as increased beyond its natural quantity, and this in some parts sooner than in others; which quantity of heat is however not to be estimated simply by the

rise of the mercury in the thermometer, but also by the quantity carried away into the atmosphere, or diffused amongst other bodies in a given time; as more heat passes through water, which boils vehemently, than when it boils gently, though the rise of the thermometer in both cases continues the same. This fact may be known by boiling an egg in water, the white of which coagulates in much less time, if the water boils vehemently, than if it boils moderately, though the sensible heat of the water is the same in both cases.

Another cause, which induces the cutaneous capillaries to renew their actions sooner than the heart and arteries after immersion in the cold bath, is, that their torpor was occasioned by defect of irritation; whereas that of the heart and arteries was occasioned by defect of association; which defect of association was owing to the decreased actions of the capillaries, and is now again excited by their renewed action; which excitement must therefore be subsequent to that increased action of the capillaries; and in consequence the increased action of the heart and arteries at the commencement of the hot fit of some fevers is subsequent to the increased action of the cutaneous capillaries. There is, however, in this case an accumulation of the sensorial power of association in the heart and arteries, which must contribute to increase their orgasm in the hot fit, as well as the increased excitement of it by the increased action of the capillaries.

4. Now this increased action of the system, during the hot fit, by exhausting the sensorial powers of irritation and association, contributes to induce a renewal of the cold paroxysm; as the accumulation of those sensorial powers in the cold fit produces the increased actions of the hot fit; which two states of the system reciprocally induce each other by a kind of libration, or a plus and minus, of the sensorial powers of irritation and association.

If the exhaustion of sensorial power during the hot fit of fever only reduces the quantity of irritability and associability to its natural standard, the fever is cured, not being liable to return. If the quantity of these sensorial powers be reduced only so much, as not to produce a second cold fit during the present quantity of external stimuli or influences; yet it may be so far reduced, that a very small subtraction of stimulus, or of influence, may again induce a cold fit; such as the coldness of the night-air, or the diminution of solar or lunar gravitation, as in intermitting fevers.

5. Another cause of the renovation of the cold fits of fever is from some parts of the system not having completely recovered from the former cold paroxysm; as happens to the spleen, liver, or other internal viscus; which sometimes remains tumid, and either occasions a return of the cold fit by direct sympathy with other parts of the body, or by its own want of action causes a diminution of the general quantity of heat, and thus facilitates the renovation of the torpor of the

whole system, and gives cause to intermittent fevers catenated with lunar or solar influence.

VIII. *Orgasm of the Capillaries.*

As the remaining torpor of some less essential part of the system, as of the spleen, when the hot fit ceases, produces after one, two, or three days a return of cold fit by direct sympathy with the cutaneous capillaries, when joined with some other cause of torpor, as the defect of solar or lunar influences, or the exposure to cold or hunger, and thus gives origin to intermit- tent fever; so the remaining torpor of some more essential parts of the system, as of the stomach and intestines, is probably the cause of the immediate recurrence of the cold paroxysm, at the time the hot one ceases, by their direct sympathy with the cutaneous capillaries, without the assistance of any other cause of torpor; and thus produces remittent fever. And lastly the remaining torpor of some still more essential parts of the system, as the heart and arteries, after the hot fit ought to cease, is liable by reverse sympathy with the cutaneous capillaries to continue their orgasm, and thus to render a fever continual, which would otherwise remit or intermit.

Many difficulties here occur, which we shall endeavour to throw some light upon, and leave to future investigation; observing only that difficulties were to be expected, otherwise fevers would long since have been understood, as they have employed the unremit- ted attention of the physicians of all ages of the world.

1. Why

1. Why do the same parts of successive trains of action sometimes affect each other by direct, and sometimes by reverse sympathy?—1st, When any irritative motion ceases, or becomes torpid, which was before in perpetual action; it is either deprived of its usual stimulus, and thence the sensorial power of irritation is not excited; or it has been previously too much stimulated, and the sensorial power has been thus exhausted.

In the former case an accumulation of sensorial power soon occurs, which is excitable by a renewal of the stimulus; as when the fingers, which have been immersed some time in snow, are again exposed to the usual warmth of a room. Or, secondly, the sensorial power of irritation becomes so much accumulated, that the motions, which were torpid, are now performed by less stimulus than natural; as appears by the warmth, which soon occurs after the first chill in going into frosty air, or into the bath at Buxton, which is about eighty degrees of heat. Or, lastly, this accumulation of the sensorial power of irritation so far abounds, that it increases the action of the next link of the associated train or tribe of motions; thus on exposing the skin to cold air, as in walking out in a frosty morning, the actions of the stomach are increased, and digestion strengthened.

But where the torpor of some irritative motion is owing to the previous exhaustion of the sensorial power of irritation by too great stimulus, the restoration of it occurs either not at all, or much more

slowly than in the former instances ; thus after intoxication the stomach is very slow in recovering its due quantity of the sensorial power of irritation, and never shews any accumulation of it.

2. When an associate motion, as described in the introduction to Class IV. 1. 1. acts with less energy, the sensorial power of association is either not sufficiently excited by the preceding fibrous motions ; or it has been expended or exhausted by the too violent actions of the preceding fibrous motions. In the former case there occurs an accumulation of the sensorial power of association ; exactly as, where the usual stimulus is withdrawn, there occurs an accumulation of the sensorial power of irritation. Thus when the actions of the capillaries of the skin are diminished by immersion in cold water, the capillaries of the lungs are rendered torpid by the want of the excitement of the sensorial power of association, owing to the lessened actions of the previous fibrous motions, namely, of those of the skin. Nevertheless as soon as the capillaries of the skin regain their increased activity by the accumulation of the sensorial power of irritation, these capillaries of the lungs act with greater energy also owing to their accumulated sensorial power of association. These are instances of direct sympathy, and constitute the cold and hot paroxysms of intermittent fever ; or the first paroxysm of a continued one.

3. When

3. When the first link of a train of associated motions, which is subject to perpetual action, becomes a considerable time torpid for want of being excited by the previous exertions of the irritative motions, with which it is catenated; the sensorial power of association becomes accumulated in so great a degree as to affect the second link of the train of associated motions, and to excite it into stronger action. Thus when the stomach is rendered torpid by contagious matter swallowed into it mixed with the saliva, the heart and arteries act more feebly; because the sensorial power of association, which used to be excited by the fibrous motions of the stomach, is not now excited; and in consequence the motions of the heart and arteries act only by the sensorial power of irritation, which is excited by the stimulus of the blood.

But during this torpor of the stomach, and less action of the heart and arteries, so great an accumulation of the sensorial powers of irritation and of association occurs, that it adds to the action of the next link of this vital circle of actions, that is, to that of the cutaneous capillaries. Whence in this situation the torpor of the stomach occasions a diminished action of the heart and arteries by direct sympathy, and may be said to occasion an increased one of the cutaneous capillaries by reverse sympathy; which constitute continued fever with weak pulse.

Nor is this increased action of the capillaries in consequence of the decreased action of the heart and arteries, as in fevers with weak pulse, a single fact

in the animal economy ; though it exists in this case in the greatest degree or duration, because the heart and arteries are perpetually in greater action than any other part of the system. But a similar circumstance occurs, when the stomach is rendered inactive by defective excitement of the sensorial power of association, as in sea-sickness, or in nephritis. In these cases the sensorial power of association becomes much accumulated in the stomach, and seems by its superabundance to excite the absorbent system, which is so nearly connected with it, into great increase of action ; as is known by the great quantity frequently in these situations rejected by vomit, which could not otherways be supplied. It is probable the increase of digestion by walking in frosty air, with many other animal facts, may by future observations be found to be dependent on this principle, as well as the increased action of the capillaries in continued fevers with weak pulse.

Whereas in continued fever with strong pulse, which may perhaps occur sometimes on the first day even of the plague, the stomach with the heart and arteries and the capillaries act by direct sympathy ; that is, the stomach is excited into stronger action by increased irritation owing to the stimulus of contagious matter ; these stronger irritative motions of the stomach excite a greater quantity of the sensorial power of association, which then actuates the heart and arteries with greater energy, as these are catenated with the stomach ; and in the same manner the increased actions
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of the heart and arteries excite a greater quantity of the sensorial power of association which actuates the cutaneous capillaries with increase of energy. See Class IV. 1. 1.

4. I shall dwell a little longer on this intricate subject. The commencement of fever-fits is known by the inactivity of the cutaneous capillaries, which inactivity is observable by the paleness and coldness of the skin, and also by the pain of coldness, which attends it. There is nevertheless in most cases, except those which are owing to exposure to external cold, a torpor of the capillaries of some internal viscus preceding this inactivity of the cutaneous capillaries; which is known by the tumor or hardness of the viscus, or by an aching pain of it. The capillaries of the lungs are at the same time rendered inactive or torpid, as appears by the difficulty of breathing, and coldness of the breath in cold fits of fever, and in going into the cold bath; but the lungs are not affected with the pain either of coldness or of torpor.

One cause of this synchronous or successive inactivity of the cutaneous capillaries, in consequence of the previous torpor of some internal viscus, may be owing to the deficiency of heat; which must occur, when any part becomes inactive; because the secretions of that part cease or are lessened, and the quantity of heat of it in consequence. But the principal cause of it I suppose to be owing to the defect of the sensorial power of association; which power of association

ciation is excited by some previous or concomitant motions of the parts of every great circle of actions. This appears on going into the cold bath, because the shortness of breath instantly occurs, sooner than one can conceive the diminution of the heat of the skin could affect the lungs by the want of its stimulus ; but not sooner than the defect of the sensorial power of association could affect them ; because this must cease to be excited into action on the instant that the cutaneous capillaries cease to act ; whence in the first moment of contact of the cold water the cutaneous capillaries cease to act from defect of irritation ; which is caused by defect of the stimulus of heat ; and in the second moment the capillaries of the lungs cease to act from the defect of association ; which is caused by the defect of the motions of the cutaneous capillaries. Thus the universal torpor in the cold paroxysm of fever is an example of direct sympathy, though occasioned in part by defect of irritation, and in part by defect of association.

5. Thus in walking out in a frosty morning the skin is cooled by the contact of the cold air, whence the actions of its capillaries are diminished for want of their usual stimulus of heat to excite a sufficient quantity of the sensorial power of irritation. Hence there is at first a saving of sensorial power of irritation for the purpose of actuating the other parts of the system with greater energy. Secondly the sensorial power of association, which used to be excited by the motions

motions of the cutaneous capillaries, is now not so powerfully excited; and in consequence the parts, which constitute the next links of the circles of associated motions, are for a time actuated with less energy, and a temporary general chillness succeeds; which is so far similar to the cold fit of intermittent fever.

In this situation there is a curious circumstance occurs, which merits peculiar attention: after a short time, though the external skin continues cool by its exposure to the cold air, and the actions of its capillaries are consequently diminished, yet the capillaries of the stomach act with greater energy; as is known by increased digestion and consequent hunger. This is to be ascribed to the accumulation of the sensorial power of irritation, which now excites by its superabundance, or overflowing, as it were, the stomach into increased action; though it is at the same time excited less powerfully than usual by the sensorial power of association. Thus the accumulation of the sensorial power of irritation in the vessels of the skin increases in this case the action of the stomach, in the same manner as an accumulation of the sensorial power of association in the heart and arteries in fevers with weak pulse increases the action of the capillaries.

If nevertheless the coldness of the skin be too long continued, or exists in too great a degree, so as in some measure to impair the life of the part, no further accumulation of the sensorial power of irritation

tation occurs ; and in consequence the actions of the stomach become less than natural by the defect of the sensorial power of association ; which has ceased to be excited by the want of action of the cutaneous capillaries. Whence continued coldness of the feet is accompanied with indigestion and heartburn. See Class IV. 2. 1. 6.

6. Similar to this when the actions of the stomach are rendered torpid by the previous stimulus of a violent emetic, and its motions become retrograde in consequence, a great quantity of sensorial power is exerted on the lymphatics of the lungs, and other parts of the body ; which excites them into greater direct action, as is evinced by the exhibition of digitalis in anasarca. In this situation I suppose the emetic drug stimulates the muscular fibres of the stomach into too great action ; and that in consequence a great torpor soon succeeds ; and that this inaction of the muscular parts of the stomach is not followed by much accumulation of the sensorial power of irritation ; because that sensorial power is in great measure exhausted by the previous excessive stimulus. But the lymphatics of the stomach have their actions lessened by defect of the sensorial power of association, which is not now excited into action, owing to the lessened motions of the muscular parts of it, with which the lymphatics are associated. The sensorial power of association becomes therefore accumulated in these lymphatics of the stomach, because it is not
excited

excited into action ; exactly as the power of irritation becomes accumulated in the hand, when immersed in snow ; and this accumulated sensorial power of association excites the lymphatics of the lungs and of other parts, which are most nearly associated with those of the stomach, into more energetic actions. Thus the muscular fibres of the stomach act with the lymphatics of that organ in direct sympathy ; and the lymphatics of the stomach act in reverse sympathy with those of the lungs and of other parts of the body ; the former of which is caused by defect of the excitement of the sensorial power of association, and the latter by the accumulation of it.

Besides the efficient cause, as above explained, the final cause, or convenience, of these organic actions are worthy our attention. In this case of an acrid drug swallowed into the stomach the reverted actions of the muscular fibres of the stomach tend to eject its enemy ; the reverted actions of its lymphatics pour a great quantity of fluids into the stomach for the purpose of diluting or washing off the noxious drug ; and the increased actions of the other lymphatics supply these retrograde ones of the stomach with an inconceivable supply of fluids, as is seen in Ileus and Cholera.

7. The inquisitive reader will excuse my continuing this subject, though perhaps with some repetitions, as it envelopes the very essence of fever. When the first link of a train of actions is excited by excessive stimulus,

stimulus, or excessive irritability, and thus acts with unusual energy by the increased quantity of irritation, these increased motions excite a greater quantity of the sensorial power of association, which causes increased motions in the second link, which is catenated with the first; and then the excessive action of this second link excites also a greater quantity of the sensorial power of association, which increases the motions of the third link of this chain of association, and thus the increase of the stimulus on the irritative motions, to which the chain of association is catenated, increases the action of the whole chain or circle of associated motions.

After a time the irritative motions become torpid by expenditure of the sensorial power of irritation, and then the power of association also becomes less exerted, both because it has been in part exhausted by too great action, and is now less excited by the lessened action of the irritative motions, which used to excite it. These are both instances of direct sympathy, and frequently constitute the cold and hot fit of intermittents.

But though the accumulation of the sensorial power of irritation during the quiescence of some motion owing to want of stimulus generally induces torpor in the first link of the train of associated motions catenated with it; as the capillaries of the lungs become torpid immediately on immersion of the skin into cold water; yet in some situations an orgasm or excess of action is produced in the first link of the associated

motions thus catenated with irritative ones ; as in the increased action of the stomach, when the skin is for a time exposed to cold air ; which may in part be ascribed to the general increase of action of the whole system, owing to the diminished expenditure of sensorial power, but particularly of the parts, which have habitually acted together ; as when one arm is paralytic the other is liable to more frequent or almost continual motion ; and when one eye becomes blind the other frequently becomes stronger ; which is well known to farriers, who are said sometimes to destroy the sight of one eye to strengthen that of the other in diseased horses.

Hence there is sometimes a direct sympathy, and sometimes a reverse one succeeds the torpor occasioned by defect of stimulus, the latter of which is perhaps owing to a certain time being required for the production of an accumulation of the sensorial power of irritation by the nervous branches of the torpid organ ; which accumulation is now in part or entirely derived to the next link of the association. Thus in going into a coldish bath, as into a river in the summer months, we at first experience a difficulty of breathing from the torpid action of the pulmonary capillaries, owing to the deficient excitement of the sensorial power of association in consequence of the torpor of the cutaneous capillaries. But in a very short time, as in one minute, the sensorial power of irritation becomes accumulated by the inactivity of the cutaneous capillaries ; and as its superabundance be-

comes now expended on the pulmonary capillaries, the difficult respiration ceases; though the cutaneous capillaries continue torpid by their contact with the cold water, and consequently the sensorial power of association, which used to contribute to actuate the pulmonary capillaries, is less excited.

8. In like manner when there exists an accumulation of the sensorial power of association, owing to defect of its excitement by some previous irritative or associate motions, it is generally accompanied for a certain time by a torpor not only of the link first affected, but of the subsequent parts, or of the whole train of associated motions, as in the cold fits of intermittent fevers. Yet after a time an increased action of the next links of associated motions succeeds the torpor of the first, as the absorbent vessels of the lungs act more violently in consequence of the deficient action of those of the stomach; and the skin at the commencement of sickness is pale and cold, but in a little time becomes flushed and warm.

Thus we see in associate motions, which are rendered torpid by defect of excitement, that sometimes a direct, and sometimes a reverse sympathy succeeds in the subsequent links of the chain. But I believe where a torpor of irritative or of the associate motions is caused by a previous too great expenditure or exhaustion of the sensorial powers of irritation or association, no increase of action in the subsequent link ever occurs, or not till after a very long time.

Thus

Thus when the stomach becomes torpid by previous violent exertion, and consequent exhaustion of the sensorial power of irritation, as after intoxication with wine or opium, or after the exhibition of some violent emetic drug, the torpor is communicated to the heart and arteries, as in continued fevers with weak pulse. But where the torpor of the stomach is produced from defective association, as in sea-sickness; or in the sickness which occurs, when a stone stimulates the ureter; no torpor is then communicated to the heart and arteries. For in the former case there is no accumulation of sensorial power in the stomach, which was previously exhausted by too great stimulus; but in the latter case the accumulation of sensorial power in the stomach during its torpor is evinced by this circumstance; that in sea-sickness the patients eat and drink voraciously at intervals; and the pulse is generally not affected by the sickness occasioned by a stone in the ureter. For the action of the stomach is then lessened, and in consequence becomes retrograde, not owing to the exhaustion of the sensorial power of irritation, but to the want of excitement of the sensorial power of association; which is caused by the defective action of the ureter, which becomes occasionally torpid by the great stimulus of the stone it contains; or which is caused by the great exhaustion of sensorial power by the pain; which affects the ureter without exciting inflammation, or increased action of it.

9. Thus though the stomach after the great stimulus of intoxication from excess of wine or opium will

continue many hours without accumulation of sensorial power, as appears from the patient's experiencing no appetite at the intervals of sickness; yet after long abstinence from food, at length not only the exhausted quantity of sensorial power is renewed, but an accumulation of it at length occurs, and hunger returns. In this situation the stomach is generally about a whole day before it regains its usual powers of digestion; but if it has been still more violently stimulated, and its actions further impaired, a still more permanent torpor along with a continued fever with weak pulse is liable to occur; and a fourth part, or a half, or three fourths, or a whole lunar period passes, before it recovers its due irritability and consequent action.

In similar manner, after a person has been confined in a very warm room for some hours, the cutaneous capillaries, with their secretory and absorbent vessels, become exhausted of their sensorial power of irritation by the too great violent exertions occasioned by the unusual stimulus of heat; and in coming into a colder atmosphere an inactivity of the cutaneous vessels exists at first for some time without accumulation of sensorial power; as is shewn by the continuance of the pain of cold and the paleness; but after a time both the pain of cold and paleness vanish, which now indicates an accumulation of the sensorial power of irritation, as less degrees of heat stimulate the system into due action.

In the same manner, after any one has been some time in the summer sunshine, on coming into a dark cell he continues much longer before he can clearly
distinguish

distinguish objects, than if his eyes had only been previously exposed to the light of a cloudy day in winter; because the sensorial power of irritation, and consequent sensation, had in the first case been previously much expended or exhausted; and therefore required a much longer time before it could be produced in the brain, or derived to the optic nerves, in such quantity as to restore the deficiency, and to cause an accumulation of it; whereas in the latter case no deficiency had occurred.

10. Thus the accumulation or deficiency of sensorial power in a torpid organ, which had previously been accustomed to perpetual action, depends on the manner in which it becomes torpid; that is, whether by great previous stimulus, or great previous excitement of the power of association; or by defect of its accustomed stimulus, or of its accustomed excitement of the power of association. In the former case the sensorial power is in an exhausted state, and therefore is not likely to become so soon accumulated, as after drunkenness, or exposure to great heat, or to great light; in the latter a great accumulation of sensorial power occurs, as after exposure to cold, or hunger, or darkness.

Hence when the stomach continues torpid by previous violent stimulus, as in the exhibition of digitalis, no accumulation of sensorial power of irritation supervenes; and in consequence the motions of the heart and arteries, which are associated with those of the

stomach, become weak, and slow, and intermittent, from the defect of the excitement of the sensorial power of association. But what follows? as the actions of the heart and arteries are lessened by the deficient action of the sensorial power of association, and not by previous increased excitement of it; a great accumulation of the sensorial power of association occurs, which is exerted on the pulmonary and cutaneous absorbents by reverse sympathy, and produces a great absorption of the fluid effused into the cellular membrane in anasarca, with dry skin; constituting one kind of atrophy.

But if at the same time the secreting vessels of the stomach are stimulated into so violent activity as to induce great consequent torpor, as probably happens when contagious matter is swallowed into the stomach with our saliva, those of the heart and arteries act feebly from the deficient excitement of the power of association; and then the cutaneous and pulmonary secreting vessels act with greater force than natural, owing to the accumulation of the sensorial power of association; and unnatural heat of the skin, and of the breath succeed; but without frequency of pulse, constituting the *paresis irritativa* of Class I. 2. 1. 2. And lastly, if a paucity of blood attends this paresis, or some other cause inducing a frequency of pulse, the *febris inirritativa*, or fever with weak pulse, is produced.

But on the contrary when the stomach has previously been rendered torpid by defect of stimulus,

as by hunger, if food be too hastily supplied, not only great exertion of the stomach itself succeeds, but fever with strong pulse is induced in consequence; that is, the heart and arteries are excited into more energetic action by the excess of the power of association, which catenates their motions with those of the stomach. For the redundancy of sensorial power of irritation, which was accumulated during the inactivity of the stomach, and is now called into action by stimulus, actuates that organ with increased energy, and excites by these increased motions the sensorial power of association; which has also been accumulated during the inactivity of the heart and arteries; and thus these organs also are now excited into greater action.

So after the skin has been exposed some hours to greater heat than natural in the warm room, other parts, as the membranes of the nostrils, or of the lungs, or of the stomach, are liable to become torpid from direct sympathy with it, when we come into air of a moderate temperature; whence catarrhs, coughs, and fevers. But if this torpor be occasioned by defect of stimulus, as after being exposed to frosty air, the accumulation of sensorial power is exerted, and a glow of the skin follows, with increased digestion, full respiration, and more vigorous circulation.

II. It may be asked, Why is there a great and constant accumulation of the sensorial power of association, owing to the torpor of the stomach and

heart and arteries, in continued fever with weak pulse; which is exerted on the cutaneous and pulmonary capillaries, so as to excite them into increased action for many weeks, and yet no such exuberance of sensorial power produces fever in winter-sleeping animals, or in chlorosis, or apepsia, or hysteria?

In winter-sleeping animals I suppose the whole nervous system is torpid, or paralyzed, as in the sleep of frozen people; and that the stomach is torpid in consequence of the inactivity or quiescence of the brain; and that all other parts of the body, and the cutaneous capillaries with the rest, labour under a similar torpor.

In chlorosis, I imagine, the actions of the heart and arteries, as well as those of the cutaneous and pulmonary capillaries, suffer along with those of the stomach from the deficient stimulus of the pale blood; and that though the liver is probably the seat of the original torpor in this disease, with which all other parts sympathize from defect of the excitation of the sensorial power of association; yet as this torpor occurs in so small a degree as not to excite a shuddering or cold fit, no observable consequences are in general occasioned by the consequent accumulation of sensorial power. Sometimes indeed in chlorosis there does occur a frequent pulse and hot skin; in which circumstances I suppose the heart and arteries are become in some degree torpid by direct sympathy with the torpid liver; and that hence not only the pulse becomes frequent, but the capillaries of the skin act more violently
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by reverse sympathy with the heart and arteries, owing to the accumulation of the sensorial power of association in them during their torpid state, as occurs in irritative fever. See Article 11 of this Supplement.

In *apepsia chronica* the actions of the stomach are not so far impaired or destroyed as totally to prevent the excitation of the sensorial power of association, which therefore contributes something towards the actions of the heart and arteries, though less than natural, as a weak pulse always I believe attends this disease.

There is a torpor of the stomach, and of the upper part of the alimentary canal in *hysteria*, as is evident from the retrograde actions of the duodenum, stomach, and œsophagus, which constitute the *globus hystericus*, or sensation of a globe rising into the throat. But as these retrograde actions are less than those, which induce sickness or vomiting, and are not occasioned by previous exhaustion of the sensorial power of irritation, they do not so totally prevent the excitement of the sensorial power of association, as to lessen the motion of the heart and arteries so much as to induce fever; yet in this case, as in *apepsia*, and in *chlorosis*, the pulsations of the heart and arteries are weaker than natural, and are sometimes attended with occasionally increased action of the capillaries; as appears from the flushings of the face, and hot skin, which generally form an evening *febricula* in diseases attended with weak digestion.

12. The increased action, or orgasm, of the cutaneous, pulmonary, and cellular capillaries, with their fecerning and absorbent vessels, in those fevers which are attended with deficiency of vital action, exhausts the patient both by the additional expenditure of sensorial power on those organs of secretion, and by the too great absorption of the mucus and fat of the body; whence great debility and great emaciation. Hence one great indication of cure of continued fever with arterial debility is to diminish the too great action of the capillaries; which is to be done by frequent ablutions, or bathing the whole skin in tepid or in cold water, as recommended by Dr. Currie of Liverpool (*Philos. Trans.* for 1792), for half an hour, twice a day, or at those times when the skin feels driest and hottest. Much cool air should also be admitted, when the breath of the patient feels hot to one's hand; or when the tongue, especially its middle part, is dry, and covered with a crust of indurated mucus; as these indicate the increased action of the pulmonary capillaries; in the same manner as the dry and hot skin indicates the orgasm of the cutaneous capillaries; and the emaciation of the body that of the cellular ones.

For this purpose of abating the action of the capillaries by frequent ablution or fomentation, water of any degree of heat beneath that of the body will be of service, and ought in accurate language to be called a cold bath; but the degree of coldness, where the patient is sensible, should in some measure be governed

governed by his sensations; as it is probable, that the degree of coldness, which is most grateful to him, will also be of the greatest benefit to him. See Class III. 2. 1. 12. and Article 15 of this Supplement.

Another great use of frequent ablutions, or fomentations, or baths, in fevers, where the stomach is in some degree torpid, is to supply the system with aqueous fluid by means of the cutaneous absorbents; which is dissipated faster by the increased action of the secreting capillaries, than the stomach can furnish, and occasions great thirst at the intervals of the sickness.

IX. *Torpor of the Lungs.*

1. The lungs in many cases of contagion may first be affected with torpor, and the skin become cold by sympathy; in the same manner as a cold skin on going into the cold bath induces difficulty of breathing. Or the stomach may become affected with torpor by its sympathy with the lungs, as in the experiments of Mr. Watt with hydro-carbonate gas; a few respirations of which induced sickness, and even syncope. When the stomach or skin is thus affected secondarily by association, an accumulation of sensorial power occurs much sooner, than when these parts become torpid in consequence of previous excess of stimulus; and hence they sooner recover their accustomed action, and the fever ceases. The particles of contagious matter thus received by respiration some-
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what resemble in their effects the acid gases from burning sulphur, or from charcoal; which, if they do not instantly destroy, induce a fever, and the patient slowly recovers.

2. I was some years ago stooping down to look, which way the water oozed from a morass, as a labourer opened it with a spade, to detect the source of the spring, and inhaled a vapour, which occasioned an instant sense of suffocation. Immediately recoiling I believe I inhaled it but once; yet a few hours afterwards in the cool of the evening, when I returned home rather fatigued and hungry, a shivering and cold fit occurred, which was followed by a hot one; and the whole disease began and terminated in about twelve hours without return. In this case the power of fear, or of imagination, was not concerned; as I neither thought of the bad air of a morass before I perceived it; nor expected a fever-fit, till it occurred.

In this case the torpor commenced in the lungs, and after a few hours, by the addition of fatigue, and cold, and hunger, was propagated by direct sympathy to the rest of the system. An orgasm or increased action of the whole system was then induced by the accumulation of sensorial power of irritation in the lungs, and of association in the other organs; and when these subsided, the disease ceased. It may be asked, could a torpor of the capillaries of the air-vessels of the lungs be so suddenly produced by great stimulation?

lation?—It appears probable, that it might, because great exertion of irritative motions may be instantly produced without our perceiving them; that is, without their being attended by sensation, both in the lungs and stomach; and the organs may become torpid by the great expenditure of the sensorial power of irritation in an instant of time; as paralysis frequently follows too great an exertion of voluntary power.

3. When the capillaries of the lungs act too violently, as in some continued fevers; which is known by the heat of the breath, and by the dryness of the tongue, especially of the middle part of it; not only cooler air might be admitted more freely into a sick room to counteract this orgasm of the pulmonary capillaries; but perhaps the patient might breathe with advantage a mixture of carbonic acid gas, or of hydrogen gas, or of azote with atmospheric air. And on the contrary, when there exists an evident torpor of the pulmonary capillaries, which may be known by the correspondent chillness of the skin; and by a tickling cough, which sometimes attends cold paroxysms of fever, and is then owing to the deficient absorption of the pulmonary mucus, the saline parts of which stimulate the bronchiæ, or air-vessels; a mixture of one part of oxygen gas with 10 or 20 parts of atmospheric air might probably be breathed with great advantage.

X. *Torpor of the Brain.*

As the inactivity or torpor of the absorbent vessels of the brain is the cause of hydrocephalus internus; and as the deficiency of venous absorption in the brain, or torpor of the extremities of its veins, is believed frequently to be the cause of apoplexies; so there is reason to conclude, that the torpor of the secreting vessels of the brain, which are supposed to produce the sensorial power, may constitute the immediate cause of some fevers with arterial debility. And also that the increased action of these secreting vessels may sometimes constitute the immediate cause of fevers with arterial strength.

It is nevertheless probable, that the torpor or orgasm of the sanguiferous, absorbent, or secreting vessels of the brain may frequently exist as a secondary effect, owing to their association with other organs, as the stomach or lungs; and may thus be produced like the torpor of the heart and arteries in inirriative fevers, or like the orgasm of those organs in irriative fevers, or inflammatory ones.

Where there exists a torpor of the brain, might not very slight electric shocks passed frequently through it in all directions be used with advantage? Might not fomentations of 94 or 96 degrees of heat on the head for an hour at a time, and frequently repeated, stimulate the brain into action; as in the revival of winter-sleeping animals by warmth? Ether externally

externally might be frequently applied, and a blister on the shaved head.

Where the secreting vessels of the brain act with too great energy, as in some inflammatory fevers, might it not be diminished by laying the patient horizontally on a mill-stone, and whirling him, till sleep should be produced, as the brain becomes compressed by the centrifugal force? See Article 15 of this Supplement.

XI. *Torpor of the Heart and Arteries.*

1. It was shewn in Class IV. 1. 1. 6. in IV. 2. 1. 2. and in Suppl. I. 6. 3. that a reverse sympathy generally exists between the lacteal and lymphatic branches of the absorbent system. Hence, when the motions of the absorbents of the stomach are rendered torpid or retrograde in fevers with arterial debility, those of the skin, lungs, and cellular membrane, act with increased energy. But the actions of the muscular fibres of the heart and arteries are at the same time associated with those of the muscular fibres of the stomach by direct sympathy. Both these actions occur during the operation of powerful emetics, as squill, or digitalis; while the motions of the stomach continue torpid or retrograde, the cellular and cutaneous absorbents act with greater energy, and the pulsations of the heart and arteries become weaker, and sometimes slower.

2. The increased action of the stomach after a meal, and of the heart and arteries at the same time from
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the stimulus of the new supply of chyle, seems originally to have produced, and to have established, this direct sympathy between them. As the increased action of the absorbents of the stomach after a meal has been usually attended with diminished action of the other branches of the absorbent system, as mentioned in Class IV. 1. 1. 6. and has thus established a reverse sympathy between them.

3. Besides the reverse sympathy of the absorbent vessels and the muscles of the stomach, and of the heart and arteries, with those of the skin, lungs, and cellular membrane; there exists a similar reverse sympathy between the secreting vessels or glands of the former of these organs with those of the latter; that is the mucous glands of the heart and arteries act generally by direct sympathy with those of the stomach; and the mucous glands of the cellular membrane of the lungs, and of the skin, act by reverse sympathy with them both.

Hence when the stomach is torpid, as in sickness, this torpor sometimes only affects the absorbent vessels of it; and then the absorbents of the cellular membrane and the skin only act with increased energy by reverse sympathy. If the torpor affects the muscular fibres of the stomach, those of the heart and arteries act by direct sympathy with it, and a weak pulse is produced, as in the exhibition of digitalis, but without increase of heat. But if the torpor also affects the glands of the stomach, the cutaneous and pulmonary glands

glands act with greater energy by their reverse sympathy with those of the stomach, and of the heart and arteries; and great heat is produced along with increased perspiration both from the skin and lungs.

3. There is some difficulty in explaining, why the actions of the extensive system of capillary glands, which exist on every other membrane and cell in the body for the purpose of secreting mucus and perspirable matter, should so generally act by reverse sympathy with those of the stomach and upper part of the intestines. It was shewn in Class IV. 1. 1. 6. that when the stomach was filled with solid and fluid aliment, the absorbents of the cellular membrane, and of the bladder, and of the skin acted with less energy; as the fluids, they were used to absorb and transmit into the circulation, were now less wanted; and that hence by habit a reverse sympathy obtained between these branches of the absorbents of the alimentary canal, and those of the other parts of the body.

Now, as at this time less fluid was absorbed by the cutaneous and cellular lymphatics, it would happen, that less would be secreted by their correspondent secreting vessels, or capillary glands; and that hence by habit, these secreting vessels would acquire a reverse sympathy of action with the secreting vessels of the alimentary canal.

Thus when the absorption of the tears by the puncta lacrymalia is much increased by the stimulus of snuff; or of an affecting idea, on the nasal ducts, as

explained in Sect. XVI. 8. 2. a great increase of the secretion of tears from the lacrymal glands is produced by the direct sympathy of the action of these glands with those of their correspondent absorbents; and that though in this case they are placed at so great a distance from each other.

4. A difficult question here occurs; why does it happen, that in fevers with weak pulse the contractions of the heart and arteries become at the same time more frequent; which also sometimes occurs in chlorosis, and in some hysteric and hypochondriac diseases, and in some insanities; yet at other times the weak pulse becomes at the same time slow, as in the exhibition of digitalis, and in paresis irritativa, described in Class I. 2. 1. 2. which may be termed a fever with slow pulse? this frequency of pulse cannot depend on heat, because it sometimes exists without heat, as towards the end of some fevers with debility.

Now as apoplexies, which are sometimes ascribed to fulness of blood, are attended with slow pulse; and as in animals dying in the slaughter house from deficiency of blood the pulse becomes frequent in extreme; may not the frequency of pulse in fevers with arterial debility be in general owing to paucity of blood? as explained in Sect. XXXII. 2. 3. and its slowness in paresis irritativa be caused by the debility being accompanied with due quantity of blood? or may not the former circumstance sometimes depend on a concomitant

comitant affection of the brain approaching to sleep? or to the unusual facility of the passage of the blood through the pulmonary and aortal capillaries? in which circumstance the heart may completely empty itself at each pulsation, though its contractions may be weak. While the latter depends on the difficulty of the passage of the blood through the pulmonary or aortal capillaries, as in the cold fits of intermittents, and in some palpitations of the heart, and in some kinds of hæmoptoe? in these cases the increased resistance prevents the heart from emptying itself, and in consequence a new diastole sooner occurs, and thus the number of pulsations becomes greater in a given time.

5. In respect to the sympathies of action, which produce or constitute fever with debility, the system may be divided into certain provinces, which are assentient or opposite to each other. First, the lacteals or absorbent vessels of the stomach, and upper part of the intestines; secondly, the lymphatics or all the other branches of the absorbent vessels, which arise from the skin, mucous membranes, cellular membranes, and the various glands. These two divisions act by reverse sympathy with each other in the hot fits of fever with debility, though by direct sympathy in the cold ones. The third division consists of the secreting vessels of the stomach and upper intestines; and the fourth of the secreting vessels of all the other parts of the body, as the capillary glands of the skin,

lungs, and cellular membrane, and the various other glands belonging to the sanguiferous system. Many of these frequently, but the capillaries always, act by reverse sympathy with those of the third division above mentioned in the hot fits of fever with debility, though by direct sympathy with them in the cold fits. Fifthly, the muscular fibres of the stomach, and upper intestines; and sixthly, the muscular fibres of the heart and arteries. The actions of these two last divisions of moving fibres act by direct sympathy with each other, both in the cold and hot fits of fevers with debility.

The efficient cause of those apparent sympathies in fevers with weak pulse may be thus understood. In the cold paroxysm of fever with weak pulse the part first affected I believe to be the stomach, and that it has become torpid by previous violent exertion, as by swallowing contagious matter mixed with saliva, and not by defect of stimulus, as from cold or hunger. The actions of this important organ, which sympathizes with almost every part of the body, being thus much diminished or nearly destroyed, the sensorial power of association is not excited; which in health contributes to move the heart and arteries, and all the rest of the system; whence an universal torpor occurs.

When the hot fit approaches, the stomach in fevers with strong pulse regains its activity by the accumulation of the sensorial power of either irritation, if it was the part first affected, or of association if it was
affected

affected in sympathy with some other torpid part, as the spleen or liver; which accumulation is produced during its torpor. At the same time all the other parts of the system acquire greater energy of action by the accumulation of the sensorial power of association, which was produced, during their inactivity in the cold fit.

But in fevers with weak pulse the stomach, whose sensorial power of irritation had been previously exhausted by violent action, acquires no such quick accumulation of sensorial power, but remains in a state of torpor after the hot fit commences. The heart and arteries remain also in a state of torpor, because there continues to be no excitement of their power of association owing to the torpid motions of the stomach; but hence it happens, that there exists at this time a great accumulation of the power of association in the less active fibres of the heart and arteries; which, as it is not excited and expended by them, increases the associability of the next link of the associated chain of motions, which consists of the capillaries or other glands; and that in so great a degree as to actuate them with unnatural energy, and thus to produce a perpetual hot fit of fever. Because the associability of the capillaries is so much increased by the accumulation of this power, owing to the lessened activity of the heart and arteries, as to over-balance the lessened excitement of it by the weaker movements of the heart and arteries.

6. When the accumulation of the sensorial power of irritation caused by defect of stimulus is greater in the first link of a train of actions, to which associated motions are catenated, than the deficiency of the excitement of the sensorial power of association in the next link, what happens?—the superabundance of the unemployed sensorial power of the first link is derived to the second; the associability of which thus becomes so greatly increased, that it acts more violently than natural, though the excitement of its power of association by the lessened action of the first link is less than natural. So that in this situation the withdrawing of an accustomed stimulus in some parts of the system will decrease the irritative motions of that part, and at the same time occasion an increase of the associate motion of another part, which is catenated with it.

This circumstance nevertheless can only occur in those parts of the system, whose natural actions are perpetual, and the accumulation of sensorial power on that account very great, when their activity is much lessened by the deduction of their usual stimulus; and are therefore only to be found in the sanguiferous system, or in the alimentary canal, or in the glands and capillaries. Of the first of which the following is an instance.

The respiration of a reduced atmosphere, that is of air mixed with hydrogen or azote, quickens the pulse, as observed in the case of Mrs. Eaton by Dr. Reynolds and Dr. Thornton; to which Dr. Beddoes adds

adds in a note, that “ he never saw an instance in which a lowered atmosphere did not at the moment quicken the pulse, while it weakened the action of the heart and arteries.” *Considerations on Factitious Airs*, by Thomas Beddoes and James Watt, Part III. p. 67. Johnson, London. By the assistance of this new fact the curious circumstance of the quick production of warmth of the skin on covering the head under the bed-clothes, which every one must at some time have experienced, receives a more satisfactory explanation, than that which is given in Class IV. 1. 1. 2. which was printed before this part of Dr. Beddoes’s *Considerations* was published.

For if the blood be deprived of its accustomed quantity of oxygen, as in covering the head in bed, and thus breathing an air rendered impure by repeated respiration, or by breathing a factitious air with less proportion of oxygen, which in common respiration passes through the moist membranes of the lungs, and mixes with the blood, the pulsations of the heart and arteries become weaker, and consequently quicker, by the defect of the stimulus of oxygen. And as these vessels are subject to perpetual motion, the accumulation of the sensorial power of irritation becomes so great by their lessened activity, that it excites the vessels next connected, the cutaneous capillaries for instance, into more energetic actions, so as to produce increased heat of the skin, and greater perspiration.

How exactly this resembles a continued fever with weak and quick pulse!—in the latter the action of the heart and arteries are lessened by defect of the excitement of the sensorial power of association, owing to the torpor or lessened actions of the stomach; hence the accumulation of the sensorial power of association in this case, as the accumulation of that of irritation in the former, becomes so abundant as to excite into increased action the parts most nearly connected, as the cutaneous capillaries.

In respect to the circumstance mentioned by Sydenham, that covering the head in bed in a short time relieved the pertinacious sickness of the patient, it must be observed, that when the action of the heart and arteries become weakened by the want of the due stimulus of the proper quantity of oxygen in the blood, that an accumulation of the sensorial power of irritation occurs in the fibres of the heart and arteries, which then is expended on those of the capillary glands, increasing their actions and consequent secretions and heat. And then the stomach is thrown into stronger action, both by the greater excitement of its natural quantity of the sensorial power of association by the increased actions of the capillaries, and also by some increase of associability, as it had been previously a long time in a state of torpor, or less activity than natural, as evinced by its perpetual sickness.

In a manner somewhat similar to this, is the redness of the skin produced in angry people by the superabundance of the unemployed sensorial power of volition,

lition, as explained in Class IV. 2. 3. 5. Rubor ex irâ. From hence we learn how, when people in fevers with weak pulse, or in dropsies, become insane, the abundance of the unemployed sensorial power of volition increases the actions of the whole moving system, and cures those diseases.

7. As the orgasm of the capillaries in fevers with weak pulse is immediately caused by the torpid actions of the heart and arteries, as above explained, this supplies us with another indication of cure in such fevers, and that is to stimulate these organs. This may probably be done by some kind of medicines, which are known to pass into the blood unchanged in some of their properties. It is possible that nitre, or its acid, may pass into the blood and increase the colour of it, and thus increase its stimulus, and the same may be supposed of other salts, neutral or metallic? As *rubia tinctoria*, madder, colours the bones of young animals, it must pass into the blood with its colouring matter at least unchanged, and perhaps many other medicines may likewise affect the blood, and thus act by stimulating the heart and arteries, as well as by stimulating the stomach; which circumstance deserves further attention.

Another way of immediately stimulating the heart and arteries would be by transfusing new blood into them. Is it possible that any other fluid besides blood, as chyle, or milk, or water, could, if managed with great art, be introduced safely or advantageously into the vein of a living animal?

A third

A third method of exciting the heart and arteries immediately is by increasing the natural stimulus of the blood, and is well worthy experiment in all fevers with weak pulse; and that consists in supplying the blood with a greater proportion of oxygen; which may be done by respiration, if the patient was to breathe either oxygen gas pure, or diluted with atmospheric air, which might be given to many gallons frequently in a day, and by passing through the moist membranes of the lungs, according to the experiments of Dr. Priestley, and uniting with the blood, might render it more stimulant, and thus excite the heart and arteries into greater action! May not some easier method of exhibiting oxygen gas by respiration be discovered, as by using very small quantities of hyperoxygenated marine acid gas very much diluted with atmospheric air?

XII. *Torpor of the Stomach and upper Intestines.*

1. The principal circumstance, which supports the increased action of the capillaries in continued fever with weak pulse, is their reverse sympathy with those of the stomach and upper intestines, or with those of the heart and arteries. The torpor of the stomach and upper intestines is apparent in continued fevers from the total want of appetite for solid food, besides the sickness with which fevers generally commence, and the frequent diarrhœa with indigested stools, at the same time the thirst of the patient is sometimes urgent at the intervals of the sickness. Why the stomach can at this time take fluids by intervals,

tervals, and not solids, is difficult to explain; except it be supposed, as some have affirmed, that the lacteal absorbents are a different branch from the lymphatic absorbents, and that in this case the former only are in a state of permanent torpor.

2. The torpor of the heart and arteries is known by the weakness of the pulse. When the actions of the absorbents of the stomach are diminished by the exhibition of small doses of digitalis, or become retrograde by larger ones, the heart and arteries act more feebly by direct sympathy; but the cellular, cutaneous, and pulmonary absorbents are excited into greater action. Whence in anasarca the fluids in the cellular membrane throughout the whole body are absorbed during the sickness, and frequently a great quantity of atmospheric moisture at the same time; as appears by the very great discharge of urine, which sometimes happens in these cases; and in ileus the prodigious evacuations by vomiting, which are often a hundred fold greater than the quantity swallowed, evince the great action of all the other absorbents during the sickness of the stomach.

3. But when the stomach is rendered permanently sick by an emetic drug, as by digitalis, it is not probable, that much accumulation of sensorial power is soon produced in this organ; because its usual quantity of sensorial power is previously exhausted by the great stimulus of the foxglove; and hence it seems
probable,

probable, that the great accumulation of sensorial power, which now causes the increased action of the absorbents, is produced in consequence of the inactivity of the heart and arteries; which inactivity is induced by deficient excitement of the sensorial power of association between those organs and the stomach, and not by any previous exhaustion of their natural quantity of sensorial power; whereas in ileus, where the torpor of the stomach, and consequent sickness, is induced by reverse sympathy with an inflamed intestine, that is, by dissevered or defective association; the accumulation of sensorial power, which in that disease so violently actuates the cellular, pulmonary, and cutaneous absorbents, is apparently produced by the torpor of the stomach and lacteals, and the consequent accumulation of the sensorial power of association in them owing to their lessened action in sickness.

4. This accounts for the dry skin in fevers with weak pulse, where the stomach and the heart and arteries are in a torpid state, and for the sudden emaciation of the body; because the actions of the cellular and cutaneous absorbents are increased by reverse sympathy with those of the stomach, or with those of the heart and arteries; that is by the expenditure of that sensorial power of association, which is accumulated in consequence of the torpor of the stomach and heart and arteries, or of either of them; this also explains the sudden absorption of the milk in puerperal fevers; and contributes along with the heat of the respired

respired air to the dryness of the mucous membrane of the tongue and nostrils.

5. Besides the reverse sympathy, with which the absorbent vessels of the stomach and upper intestines act in respect to all the other absorbent vessels, as in the exhibition of digitalis, and in ileus; there is another reverse sympathy exists between the capillaries, or secretory vessels of the stomach, and those of the skin. Which may nevertheless be occasioned by the accumulation of sensorial power by the torpor of the heart and arteries, which is induced by direct sympathy with the stomach; thus when the torpor of the stomach remains in a fever-fit, which might otherwise have intermitted, the torpor of the heart and arteries remains also by direct sympathy, and the increased cutaneous capillary action, and consequent heat, are produced by reverse sympathy; and the fever is thus rendered continual, owing primarily to the torpor of the stomach.

6. The reverse sympathy, which exists between the capillaries of the stomach and the cutaneous capillaries, appears by the chillness of some people after dinner; and contrary-wise by the digestion being strengthened, when the skin is exposed to cold air for a short time; as mentioned in Class IV. 1. 1. 4. and IV. 2. 1. 1. and from the heat and glow on the skin, which attends the action of vomiting; for though when sickness first commences, the skin is pale and cold; as it then partakes of the general torpor, which induces
the

the sickness; yet after the vomiting has continued some minutes, so that an accumulation of sensorial power exists in the capillaries of the stomach, and of the skin, owing to their diminished action; a glow of the skin succeeds, with sweat, as well as with increased absorption.

7. Nevertheless in some circumstances the stomach and the heart and arteries seem to act by direct sympathy with the cutaneous capillaries, as in the flushing of the face and glow of the skin of some people after dinner; and as in fevers with strong pulse. In these cases there appears to be an increased production of sensorial power, either of sensation, as in the blush of shame; or of volition, as in the blush of anger; or of irritation, as in the flushed face after dinner above mentioned.

This increased action of the capillaries of the skin along with the increased actions of the stomach and heart is perhaps to be esteemed a synchronous increase of action, rather than a sympathy between those organs. Thus the flushing of the face after dinner may be owing to the secretion of sensorial power in the brain being increased by the association of that organ with the stomach, in a greater proportion than the increased expenditure of it, or may be owing also to the stimulus of new chyle received into the blood.

8. When the stomach and the heart and arteries are rendered torpid in fevers, not only the cutaneous, cellular, and pulmonary absorbents are excited to act with

with greater energy; but also their correspondent capillaries and fecerning vessels or glands, especially perhaps those of the skin, are induced into more energetic action. Whence greater heat, a greater secretion of perspirable matter, and of mucus; and a greater absorption of them both, and of aerial moisture. These reverse sympathies coincide with other animal facts, as in eruption of small pox on the face and neck the feet become cold, while the face and neck are much flushed; and in the hemiplagia, when one arm and leg become disobedient to volition, the patient is perpetually moving the other. Which are well accounted for by the accumulation of sensorial power in one part of an associated series of actions, when less of it is expended by another part of it; and by a deficiency of sensorial power in the second link of association, when too much of it is expended by the first.

9. This doctrine of reverse sympathy enables us to account for that difficult problem, why in continued fevers the increased action of the cutaneous, cellular, and pulmonary capillaries proceeds without interruption or return of cold fit; though perhaps with some exacerbations and remissions; and that during a quarter, or half, or three quarters, or a whole lunation; while at the same time the pulsations of the heart and arteries are weaker than natural.

To this should be added the direct sympathy, which exists between the peristaltic motions of the fibres of the stomach, and the pulsations of the heart. And that

that the stomach has become torpid by the too great stimulus of some poisonous or contagious matter ; and this very intricate idea of continued fever with feeble pulse is reduced to curious simplicity.

The direct sympathy of the stomach and heart and arteries not only appears from the stronger and slower pulse of persons exhausted by fatigue, after they have drank a glass of wine, and eaten a few mouthfuls ; but appears also from the exhibition of large doses of digitalis ; when the patient labours under great and incessant efforts to vomit, at the same time that the actions of the absorbent system are known to be much increased by the hasty absorption of the serous fluid in anasarca, the pulsations of the heart become slow and intermittent to an alarming degree. See Class IV. 2. 1. 17 and 18.

10. It would assist us much in the knowledge and cure of fevers, if we could always determine, which part of the system was primarily affected ; and whether the torpor of it was from previous excess or defect of stimulus ; which the industry of future observers must discover. Thus if the stomach be affected primarily, and that by previous excess of stimulus, as when certain quantities of opium, or wine, or blue vitriol, or arsenic, are swallowed, it is some time in recovering the quantity of sensorial power previously exhausted by excess of stimulus, before any accumulation of it can occur. But if it be affected with torpor secondarily, by sympathy with some distant part ;

as with the torpid capillaries of the skin, that is by defective excitement of the sensorial power of association; or if it be affected by defect of stimulus of food or of heat; it sooner acquires so much accumulation of sensorial power, as to be enabled to accommodate itself to its lessened stimulus by increase of its irritability.

Thus in the hemicrania the torpor generally commences in a diseased tooth, and the membranes about the temple, and also those of the stomach become torpid by direct synchronous sympathy; and pain of the head, and sickness supervene; but no fever or quickness of pulse. In this case the torpor of the stomach is owing to defect of the sensorial power of association, which is caused by the too feeble actions of the membranes surrounding the diseased tooth, and thus the train of sympathy ceases here without affecting the motions of the heart and arteries; but where contagious matter is swallowed into the stomach, the stomach after a time becomes torpid from exhaustion of the sensorial power of irritation, and the heart and arteries act feebly from defect of the excitement of the power of association. In the former case the torpor of the stomach is conquered by accumulation of the power of association in one or two whole days; in the latter it recovers by accumulation of the power of irritation in three or four weeks.

In intermittent fevers the stomach is generally I believe affected secondarily by sympathy with the torpid cutaneous capillaries, or with some internal torpid

vifcus, and on this account an accumulation of fenforial power arifes in a few hours fufficient to reftore the natural irritability of this organ; and hence the hot fit fucceeds, and the fever intermits. Or if this accumulation of fenforial power becomes exceffive and permanent, the continued fever with ftrong pulse is produced, or febris irritativa.

In continued fevers the ftomach is frequently I fup-
pofe affected with torpor by previous excefs of ftimu-
lus, and confequent exhaustion of fenforial power, as
when contagious matter is fwallowed with the faliva,
and it is then much flower in producing an accu-
mulation of fenforial power fufficient to reftore its
healthy irritability; which is a frequent caufe of con-
tinued fever with weak pulse or febris inirritativa.
Which confifts, after the cold fit is over, in a more
frequent and more feeble action of the heart and arte-
ries, owing to their direct fympathy with the muf-
cular fibres of the torpid ftomach; together with an
increafed action of the capillaries, glands, and abfor-
bents of the fkin, and cellular membrane, owing to
their reverse fympathy with the torpid capillaries,
glands, and abforbents of the ftomach, or with thofe
of the heart and arteries.

Or in more accurate language. 1. The febris in-
irritativa, or fever with weak pulse, commences with
torpor of the ftomach, occafioned by previous ex-
haustion of fenforial power of irritation by the ftimu-
lus of contagious matter fwallowed with the faliva.
2. The whole fyftem becomes torpid from defect of
the

the excitement of the sensorial power of association owing to the too feeble actions of the stomach, this is the cold fit. 3. The whole system, except the stomach with the upper intestines, and the heart and arteries, falls into increased action, or orgasm, owing to accumulation of sensorial power of association during their previous torpor, this is the hot fit. 4. The stomach and upper intestines have not acquired their natural quantity of sensorial power of irritation, which was previously exhausted by violent action in consequence of the stimulus of contagious matter, and the heart and arteries remain torpid from deficient excitement of the sensorial power of association owing to the too feeble actions of the stomach. 5. The accumulation of sensorial power of association in consequence of the torpor of the heart and arteries occasions a perpetual orgasm, or increased action of the capillaries.

11. From hence it may be deducted first, that when the torpor of the stomach first occurs, either as a primary effect, or as a secondary link of some associate train or circle of motions, a general torpor of the system sometimes accompanies it, which constitutes the cold fit of fever; at other times no such general torpor occurs, as during the operation of a weak emetic, or during sea-sickness.

Secondly. After a time it generally happens, that a torpor of the stomach ceases, and its actions are renewed with increase of vigour by accumulation of sen-

forial power during its quiescence; as after the operation of a weak emetic, or at the intervals of seasickness, or after the paroxysm of an intermittent fever.

Thirdly. The stomach is sometimes much slower in recovering from a previous torpor, and is then the remote cause of continued fever with weak pulse; which is owing to a torpor of the heart and arteries, produced in consequence of the deficient excitement of the power of association by the too weak actions of the stomach; and to an orgasm of the capillaries of the other parts of the system, in consequence of the accumulation of sensorial power occasioned by the inactivity of the heart and arteries.

Fourthly. The torpor of the stomach is sometimes so complete, that probably the origin of its nerves is likewise affected, and then no accumulation of sensorial power occurs. In this case the patient dies for want of nourishment; either in three or four weeks, of the inirritative fever; or without quick pulse, by what we have called *parens irritativa*. Or he continues many years in a state of total debility. When this torpor suddenly commences, the patient generally suffers epileptic fits or temporary insanity from the disagreeable sensation of so great a torpor of the stomach; which also happens sometimes at the eruption of the distinct small pox; whence we have termed this disease *anorexia epileptica*. See Class II. 2. 2. 1. and III. 1. 1. 7. and Suppl. I. 14. 3.

Fifthly.

Fifthly. When this torpor of the stomach is less in degree or extent, and yet without recovering its natural irritability by accumulation of sensorial power, as it does after the cold fit of intermittent fever, or after the operation of mild emetics, or during syncope; a permanent defect of its activity, and of that of the upper intestines, remains, which constitutes apepsia, cardialgia, hypochondriasis, and hysteria. See Class I. 3. 1. 3. and I. 2. 4. 5.

Sixthly. If the torpor of the stomach be induced by direct sympathy, as in consequence of a previous torpor of the liver, or spleen, or skin, an accumulation of sensorial power will sooner be produced in the stomach; because there has been no previous expenditure of it, the present torpor of the stomach arising from defect of association. Hence some fevers perfectly intermit, the stomach recovering its complete action after the torpor and consequent orgasm, which constitute the paroxysm of fever, are terminated.

Seventhly. If the torpor of the stomach be owing to defect of irritation, as to the want of food, an accumulation of sensorial power soon occurs with an increase of digestion, if food be timely applied; or with violent inflammation, if food be given in too great quantity after very long abstinence.

Eighthly. If the torpor of the stomach be induced by defect of pleasurable sensation, as when sickness is caused by the suggestion of nauseous ideas; an accumulation of sensorial power soon occurs, and the sick-

ness ceases with the return of hunger; for in this case the inactivity of the stomach is occasioned by the subduction of agreeable sensation, which acts as a subduction of stimulus, and not by exhausting the natural quantity of sensorial power in the fibres or nerves of the stomach.

Ninthly. If the torpor of the stomach be induced by a twofold cause, as in sea-sickness. See *Vertigo rotatoria*. Class IV. 2. 1. 10. in which the first link of association acts too strongly, and in consequence expends more than usual of the sensorial power of irritation; and secondly in which sensation is produced between the links of association, and disorganizes or enfeebles them; the accumulation of sensorial power soon occurs in the stomach; as no previous expenditure of it in that organ has occurred. Whence in sea-sickness the persons take food with eagerness at times, when the vertigo ceases for a few minutes.

Tenthly. If the gastric torpor be induced by previous violent exertion, as after intoxication, or after contagious matter has been swallowed, or some poisons, as digitalis, or arsenic; an accumulation of sensorial power very slowly succeeds; whence long sickness, or continued fever, because the quantity of sensorial power already wasted must first be renewed, before an accumulation of it can be produced.

12. This leads us to a second indication of cure in continued fevers, which consists in strengthening the actions of the stomach; as the first indication consisted in decreasing the actions of the cutaneous capillaries and

and absorbents. The actions of the stomach may sometimes be increased by exhibiting a mild emetic; as an accumulation of sensorial power in the fibres of the stomach is produced during their retrograde actions. Besides the evacuation of any noxious material from the stomach and duodenum, and from the absorbents, which open their mouths on their internal surfaces, by their retrograde motion.

It is probable, that when mild emetics are given, as ipecacuanha, or antimonium tartarizatum, or infusion of chamomile, they are rejected by an inverted motion of the stomach and œsophagus in consequence of disagreeable sensation, as dust is excluded from the eye; and these actions having by previous habit been found effectual, and that hence there is no exhaustion of the sensorial power of irritation. But where strong emetics are administered, as digitalis, or contagious matter, the previous exhaustion of the sensorial power of irritation seems to be a cause of the continued retrograde actions and sickness of the stomach. An emetic of the former kind may therefore strengthen the power of the stomach immediately after its operation by the accumulation of sensorial power of irritation during its action. See Class IV. 1. 1.

Another method of decreasing the action of the stomach for a time, and thence of increasing it afterwards, is by the accumulation of the sensorial power of irritation during its torpor; as by giving ice, iced water, iced creams, or iced wine. This accounts for the pleasure, which many people in fevers with weak

pulse exprefs on drinking cold beverage of any kind.

A fecond method of exciting the ftomach into action, and of decreasing that of the capillaries in confequence, is by the ftimulus of wine, opium, bark, metallic falts of antimony, fteel, copper, arfenic, given in fmall repeated quantities; which fo long as they render the pulse flower are certainly of fervice, and may be given warm or cold, as moft agreeable to the patient. For it is poffible, that the capillaries of the ftomach may act too violently, and produce heat, at the fame time that the large mufcles of it may be in a torpid ftate; which curious circumftance future obfervations muft determine.

Thirdly. Hot fomentation on the region of the ftomach might be of moft effential fervice by its ftimulus, as heat penetrates the fyftem not by the abforbent veffels, but by external influence; whence the ufe of hot fomentation to the head in torpor of the brain; and the ufe of hot bath in cafes of general debility, which has been much too frequently neglected from a popular error occafioned by the unmeaning application of the word relaxation to animal power. If the fluid of heat could be directed to pafs through particular parts of the body with as little diffusion of its influence, as that of electricity in the fhocks from the coated jar, it might be employed with ftill greater advantage.

Fourthly. The ufe of repeated fmall electric fhocks through the region of the ftomach might be of fer-

vise

vice in fevers with weak pulse, and well deserves a trial; twenty or thirty small flocks twice a day for a week or two would be a promising experiment.

Fifthly. A blister on the back, or sides, or on the pit of the stomach, repeated in succession, by stimulating the skin frequently strengthens the action of the stomach by exciting the sensorial power of association; this especially in those fevers where the skin of the extremities, as of the hands or nose or ears, sooner becomes cold, when exposed to the air, than usual.

Sixthly. The action of the stomach may be increased by preventing too great expenditure of sensorial power in the link of previous motion with which it is catenated, especially if the action of that link be greater than natural. Thus as the capillaries of the skin act too violently in fevers with weak pulse, if these are exposed to cold air or cold water, the sensorial power, which previously occasioned their orgasm, becomes accumulated, and tends to increase the action of the stomach; thus in those fevers with weak pulse and hot skin, if the stomach be stimulated by repeated small doses of bark and wine or opium, and be further excited at the same time by accumulation of sensorial power occasioned by rendering the capillaries torpid by cold air or water, this twofold application is frequently attended with visible good effect.

By thus stimulating the torpid stomach into greater action, the motions of the heart and arteries will likewise

likewise be increased by the greater excitement of the power of association. And the capillaries of the skin will cease to act so violently, from their not possessing so great a superfluity of sensorial power as during the greater quiescence of the stomach and of the heart and arteries. Which is in some circumstances similar to the curious phenomenon mentioned in Class IV. 2. 2. 10; where, by covering the chill feet with flannel at the eruption of the small-pox, the points of the flannel stimulate the skin of the feet into greater action, and the quantity of heat, which they possess, is also confined, or insulated, and further increases by its stimulus the activity of the cutaneous vessels of the feet; and by that circumstance abates the too great action of the capillaries of the face, and the consequent heat of it.

XIII. *Case of continued fever.*

The following case of continued fever which I frequently saw during its progress, as it is less complicated than usual, may illustrate this doctrine. Master S. D. an active boy about eight years of age, had been much in the snow for many days, and sat in the classical school with wet feet; he had also about a fortnight attended a writing school, where many children of the lower order were instructed. He was seized on February the 8th, 1795, with great languor, and pain in his forehead, with vomiting and perpetual sickness; his pulse weak, but not very frequent. He took an emetic, and on the next day, had

had a blister, which checked the sickness only for a few hours; his skin became perpetually hot, and dry; and his tongue white and furred; his pulse when asleep about 104 in a minute, and when awake about 112.

Fourth day of the disease. He has had another blister, the pain of his head is gone, but the sickness continues by intervals; he refuses to take any solid food, and will drink nothing but milk, or milk and water, cold. He has two or three very liquid stools every day, which are sometimes green, but generally of a darkish yellow, with great flatulency both upwards and downwards at those times. An antimonial powder was once given, but instantly rejected; a spoonful of decoction of bark was also exhibited with the same event. His legs are bathed, and his hands and face are moistened twice a day for half an hour in warmish water, which is nevertheless much colder than his skin.

Eighth day. His skin continues hot and dry without any observable remissions, with liquid stools and much flatulency and sickness; his water when observed was of a straw colour. He has asked for cyder, and drinks nearly a bottle a day mixed with cold water, and takes three drops of laudanum twice a day.

Twelfth day. He continues much the same, takes no milk, drinks only cyder and water, skin hot and dry, tongue hot and furred, with liquid stools, and sickness always at the same time; sleeps much.

Sixteenth day. Was apparently more torpid, and once rather delirious; pulse 112. Takes only capillaire and water; sleeps much.

Twentieth day. Pulse 100, skin dry but less hot, liquid stools not so frequent, he is emaciated to a great degree, he has eaten half a tea-cup full of custard to day, drinks only capillaire and water, has thrice taken two large spoonfuls of decoction of bark with three drops of laudanum, refuses to have his legs bathed, and will now take nothing but three drops of laudanum twice a day.

Twenty-fourth day. He has gradually taken more custard every day, and began to attend to some new play things, and takes wine syllabub.

Twenty-eighth day. He daily grows stronger, eats eggs, and bread and butter, and sleeps immediately after his food, can creep on his hands and knees, but cannot stand erect.

Thirty-second day. He cannot yet stand alone safely, but seems hourly to improve in strength of body, and activity of mind.

In this case the remote cause of his fever could not be well ascertained, as it might be from having his feet cold for many successive days, or from contagion; but the latter seems more probable, because his younger brother became ill of a similar fever about three weeks afterwards, and probably received the infection from him. The disease commenced with great torpor of the stomach, which was shewn by his total aversion to solid food, and perpetual sickness; the watery stools,

stools, which were sometimes green, or of a darkish yellow, were owing to the acrimony, or acidity, of the contents of the bowels; which as well as the flatulency were occasioned by indigestion. This torpor of the stomach continued throughout the whole fever, and when it ceased, the fever ceased along with it.

The contagious material of this fever I suppose to have been mixed with the saliva, and swallowed into the stomach; that it excited the vessels, which constitute the stomach, into the greatest irritative motion like arsenic; *which might not be perceived, and yet might render that organ paralytic or inirritable in a moment of time*; as animals sometimes die by one single exertion, and consequent paralysis, without a second struggle; as by lightning, or being shot through the back part of the brain; of both which I have seen instances. I had once an opportunity of inspecting two oxen, a few minutes after they were killed by lightning under a crab-tree on moist ground in long grass; and observed, that they could not have struggled, as the grass was not pressed or bent near them; I have also seen two horses shot through the cerebellum, who never once drew in their legs after they first stretched them out, but died instantaneously; in a similar manner the lungs seem to be rendered instantly inanimate by the fumes of burning sulphur.

The lungs may be sometimes primarily affected with contagious matter floating in the atmosphere as well as the stomach, as mentioned in article 9. of this Supplement. But probably this may occur much

less frequently, because the oxygen of the atmosphere does not appear to be taken into the blood by animal absorption, as the saliva in the stomach, but passes through the moist membranes into the blood, like the ethereal fluids of electricity or heat, or by chemical attraction, and in consequence the contagious matter may be left behind; except it may sometimes be absorbed along with the mucus; of which however in this case there appeared no symptoms.

The tonsils are other organs liable to receive contagious matter, as in the small-pox, scarlet-fever, and in other sensitive irritated fevers; but no symptom of this appeared here, as the tonsils were at no time of the fever inflamed, though they were in this child previously uncommonly large.

The pain of the forehead does not seem to have been of the internal parts of the head, because the nerves, which serve the stomach, are not derived from the anterior part of the brain; but it seems to have been owing to a torpor of the external membranes about the forehead from their direct sympathy with those of the stomach; that is, from the deficient excitement of the sensorial power of association; and seemed in some measure to be relieved by the emetics and blisters.

The pulsations of the heart were weaker and in consequence quicker than natural, owing to their direct sympathy with the torpid peristaltic motions of the stomach; that is to the deficient excitement of the sensorial power of association.

The action of the cutaneous capillaries and absorbents were stronger than natural, as appeared by the perpetual heat and dryness of the skin; which was owing to their reverse sympathy with the heart and arteries. This weaker and quicker action of the heart and arteries, and the stronger action of the cutaneous capillaries and absorbents, continued throughout the disease, and may be said to have constituted the fever, of which the torpor of the stomach was the remote cause.

His tongue was not very much furred or very dry, nor his breath very hot; which shewed, that there was no great increase of the action of the mucous absorbents, nor of the pulmonary capillaries, and yet sufficient to produce great emaciation. His urine was nearly natural both in quantity and colour; which shewed, that there was no increase of action either of the kidneys, or of the urinary absorbents.

The bathing his legs and hands and face for half an hour twice a day seemed to refresh him, and sometimes made his pulse slower, and thence I suppose stronger. This seems to have been caused by the water, though subtepid, being much below the heat of his skin, and consequently contributing to cool the capillaries, and by fatiating the absorbents to relieve the uneasy sensation from the dryness of the skin.

He continued the use of three drops of tincture of opium from about the eighth day to the twenty-fourth, and for the three preceding days took along
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with it two large spoonfuls of an infusion of bark in equal parts of wine and water. The former of these by its stimulus seemed to decrease his languor for a time, and the latter to strengthen his returning power of digestion.

The daily exacerbations or remissions were obscure, and not well attended to; but he appeared to be worse on the fourteenth or fifteenth days, as his pulse was then quickest, and his inattention greatest; and he began to get better on the twentieth and twenty-first days of his disease; for the pulse then became less frequent, and his skin cooler, and he took rather more food: these circumstances seemed to observe the quarter periods of lunation.

XIV. *Termination of continued fever.*

1. When the stomach is primarily affected with torpor not by defect of stimulus, but in consequence of the previous exhaustion of its sensorial power; and not secondarily by its association with other torpid parts; it seems to be the general cause of the weak pulsations of the heart and arteries, and the consequent increased action of the capillaries, which constitute continued fever with weak pulse. In this situation if the patient recovers, it is owing to the renovation of life in the torpid stomach, as happens to the whole system in winter-sleeping animals. If he perishes, it is owing to the exhaustion of the body for want of nourishment occasioned by indigestion; which is hastened by the increased actions of the capillaries and absorbents.

2. When the stomach is primarily affected by defect of stimulus, as by cold or hunger; or secondarily by defect of the power of association, as in intermittent fevers; or lastly in consequence of the introduction of the sensorial power of sensation, as in inflammatory diseases; the actions of the heart and arteries are not diminished, as when the stomach is primarily affected with torpor by its previous exhaustion of sensorial power, but become greatly increased, producing irritative or inflammatory fever. Where this fever is continued, though with some remissions and exacerbations, the excessive action is at length so much lessened by expenditure of sensorial power, as to gradually terminate in health; or it becomes totally exhausted, and death succeeds the destruction of the irritability and associability of the system.

3. There is also another termination of the diseases in consequence of great torpor of the stomach, which are not always termed fevers; one of these is attended with so great and universal torpor, that the patient dies in the first cold fit; that is, within twelve hours or less of the first seizure; this is commonly termed sudden death. But the quickness of the pulse, and the coldness with shuddering, and with sick stomach, distinguished a case, which I lately saw, from the sudden deaths occasioned by apoplexy, or ruptured blood-vessels.

In hemicrania I believe the stomach is always affected secondarily, as no quickness of pulse generally attends

it, and as the stomach recovers its activity in about two whole days. But in the following case, which I saw last week, I suppose the stomach suddenly became paralytic, and caused in about a week the death of the patient. Miss ———, a fine young lady about nineteen, had bathed a few times, about a month before, in a cold spring, and was always much indisposed after it; she was seized with sickness, and cold shuddering, with very quick pulse, which was succeeded by a violent hot fit; during the next cold paroxysm she had a convulsion fit; and after that symptoms of insanity, so as to strike and bite the attendants, and to speak furious language; the same circumstances occurred during a third fit, in which I believe a strait waistcoat was put on, and some blood taken from her; during all this time her stomach would receive no nutriment, except once or twice a little wine and water. On the seventh day of the disease, when I saw her, the extremities were cold, the pulse not to be counted, and she was unable to swallow, or to speak; a clyster was used with turpentine and musk and opium, with warm fomentations, but she did not recover from that cold fit.

In this case the convulsion fit and the insanity seem to have been violent efforts to relieve the disagreeable sensation of the paralytic stomach; and the quick pulse, and returning fits of torpor and of orgasm, evinced the disease to be attended with fever, though it might have been called *anorexia maniacalis*, or *epileptica*.

4. Might not many be saved in these fevers with weak pulse for a few weeks by the introduction of blood into a vein, once in two or three days; which might thus give further time for the recovery of the torpid stomach? Which seems to require some weeks to acquire its former habits of action, like the muscles of paralytic patients, who have all their habits of voluntary affociations to form afresh, as in infancy.

If this experiment be again tried on the human subject, it should be so contrived, that the blood in passing from the well person to the sick one should not be exposed to the air; it should not be cooled or heated; and it should be measured; all which may be done in the following manner. Procure two silver pipes, each about an inch long, in the form of funnels, wide at top, with a tail beneath, the former something wider than a swan-quill, and the latter less than a small crow-quill. Fix one of these silver funnels by its wide end to one end of the gut of a chicken fresh killed about four or six inches long, and the other to the other end of the gut; then introduce the small end of one funnel into the vein of the arm of a well person downwards towards the hand; and laying the gut with the other end on a water-plate heated to 98 degrees in a very warm room, let the blood run through it. Then pressing the finger on the gut near the arm of the well person, slide it along so as to press out one gutful into a cup, in order to ascertain the quantity by weight. Then introduce the other end of the other funnel into a similar vein in the arm of the sick person

upwards towards the shoulder; and by sliding one finger, and then another reciprocally, along the chicken's gut, so as to compress it, from the arm of the well person to the arm of the sick one, the blood may be measured, and thus the exact quantity known which is given and received. See Class I. 2. 3. 25.

XV. *Inflammation excited in fever.*

1. When the actions of any part of the system of capillaries are excited to a certain degree, sensation is produced, along with a greater quantity of heat, as mentioned in the fifth article of this supplement. When this increased capillary action becomes still more energetic, by the combined sensorial powers of sensation with irritation, new fibres are secreted, or new fluids, (which harden into fibres like the mucus secreted by the silk-worm, or spider, or pinna,) from which new vessels are constructed; it is then termed inflammation: if this exists in the capillary vessels of the cellular membrane or skin only, with feeble pulsations of the heart and arteries, the febris sensitiva inirritata, or malignant fever, occurs; if the coats of the arteries are also inflamed, the febris sensitiva irritata, or inflammatory fever, exists.

In all these fevers the part inflamed is called a phlegmon, and by its violent actions excites so much pain, that is, so much of the sensorial power of sensation, as to produce more violent actions, and inflammation, throughout the whole system. Whence great heat from the excited capillaries of the skin,
large

large and quick pulsations of the heart, full and hard arteries, with great universal secretions and absorptions. These perpetually continue, though with exacerbations and remissions; which seem to be governed by solar or lunar influence.

2. In this situation there generally, I suppose, exists an increased activity of the discerning vessels of the brain, and consequently an increased production of sensorial power; in less violent quantity of this disease however the increase of the action of the heart and arteries may be owing simply to the accumulation of sensorial power of association in the stomach, when that organ is affected by sympathy with some inflamed part. In the same manner as the capillaries are violently and permanently actuated by the accumulation of the sensorial power of association in the heart and arteries, when the stomach is affected primarily by contagious matter, and the heart and arteries secondarily. Thus I suspect, that in the distinct small-pox the stomach is affected secondarily by sympathy with the infected tonsils or inoculated arm; but that in the confluent small-pox the stomach is affected primarily, as well as the tonsils, by contagious matter mixed with the saliva, and swallowed.

3. In inflammatory fevers with great arterial action, as the stomach is not always affected with torpor, and as there is a direct sympathy between the stomach and heart, some people have believed, that nauseating

doses of some emetic drug, as of antimonium tartarifatum, have been administered with advantage, abating by direct sympathy the actions of the heart. This theory is not ill founded, and the use of digitalis, given in small doses, as from half a dram to a dram of the saturated tincture, two or three times a day, as well as other less violent emetic drugs, would be worth the attention of hospital physicians.

Sickness might also be produced probably with advantage by whirling the patient in a chair suspended from the ceiling by two parallel cords; which after being revolved fifty or one hundred times in one direction, would return with great circular velocity, and produce vertigo, similar I suppose to sea-sickness. And lastly the sickness produced by respiring an atmosphere mixed with one tenth of carbonated hydrogen, discovered by Mr. Watt, and published by Dr. Beddoes, would be well worthy exact and repeated experiment.

4. Cool air, cool fomentations, or ablutions, are also useful in this inflammatory fever; as by cooling the particles of blood in the cutaneous and pulmonary vessels, they must return to the heart with less stimulus, than when they are heated above the natural degree of ninety-eight. For this purpose snow and ice have been scattered on the patients in Italy; and cold bathing has been used at the eruption of the small pox in China, and both, it is said, with advantage. See Class III. 2. 1. 12. and Suppl. I. 8.

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5. The lancet however with repeated mild cathartics is the great agent in destroying this enormous excitement of the system, so long as the strength of the patient will admit of evacuations. Blisters over the painful part, where the phlegmon or topical inflammation is situated, after great evacuation, is of evident service, as in pleurisy. Warm bathing for half an hour twice a day, when the patient becomes enfeebled, is of great benefit, as in peripneumony and rheumatism.

6. When other means fail of success in abating the violent excitement of the system in inflammatory diseases, might not the shaved head be covered with large bladders of cold water, in which ice or salt had been recently dissolved; and changed as often as necessary, till the brain is rendered in some degree torpid by cold?—Might not a greater degree of cold, as iced water, or snow, be applied to the cutaneous capillaries?

7. Another experiment I have frequently wished to try, which cannot be done in private practice, and which I therefore recommend to some hospital physician; and that is, to endeavour to still the violent actions of the heart and arteries, after due evacuations by venesection and cathartics, by gently compressing the brain. This might be done by suspending a bed, so as to whirl the patient round with his head most distant from the centre of motion, as if he lay across a mill-stone, as described in Sect. XVIII. 20,

For this purpose a perpendicular shaft armed with iron gudgeons might have one end pass into the floor, and the other into a beam in the ceiling, with an horizontal arm, to which a small bed might be readily suspended.

By thus whirling the patient with increasing velocity sleep might be produced, and probably the violence of the actions of the heart and arteries might be diminished in inflammatory fevers; and, as it is believed, that no accumulation of sensorial power would succeed a torpor of the origin of the nerves, either thus procured by mechanical compression, or by the bladder-cap of cold water above described, the lives of thousands might probably be saved by thus extinguishing the exacerbations of febrile paroxysms, or preventing the returns of them.

In fevers with weak pulse, sleep, or a degree of stupor, thus produced, might prevent the too great expenditure of sensorial power, and thus contribute to preserve the patient. See Class I. 2. 5. 10. on stupor. What might be the consequence of whirling a person with his head next the centre of motion, so as to force the blood from the brain into the other parts of the body, might be discovered by cautious experiment without danger, and might probably add to our ability of curing fever.

XVI. *Recapitulation.*

1. The sensorial power causes the contraction of the fibres, and is excited into action by four different circumstances, by the stimulus of external bodies, by
pain

pain or pleasure, by desire or aversion, or by the previous, motions of other contracting fibres. In the first situation it is called the sensorial power of irritation, in the second the sensorial power of sensation, in the third the sensorial power of volition, and in the fourth the sensorial power of association.

Many parts of the body are excited into perpetual action, as the sanguiferous vessels consisting of the heart, arteries, and veins; others into nearly perpetual action, as the conglomerate and capillary glands; and others into actions still somewhat less frequent, as the alimentary canal, and the lacteal and lymphatic absorbents with their conglobate glands: all these are principally actuated by the sensorial powers of irritation, and of association; but in some degree or at some times by those of sensation, and even of volition. There are three kinds of stimulus, which may easily be occasionally diminished, that of heat on the skin, of food in the stomach, and of the oxygenous part of the atmosphere, which mixes with the blood in respiration, and stimulates the heart and arteries.

2. When any parts, which are naturally excited into perpetual action by stimulus, become torpid or less active from decrease of that stimulus; there first occurs a decrease of the activity of the parts next catedenated with them; thus going into cold water produces a torpor of the capillary vessels of the lungs, as is known by the difficult respiration, which immediately occurs; for the sensorial power of association, which naturally

naturally contributes to actuate the lungs, is now less excited by the decreased actions of the cutaneous vessels, with which they are catenated. This constitutes the cold fit of fever.

There next occurs an accumulation of the sensorial power of irritation in the parts, which were torpid from defect of stimulus, as the cutaneous vessels for instance when exposed to cold air; and a similar accumulation of the sensorial power of association occurs in the parts which were catenated with the former, as the vessels of the lungs in the example above mentioned. Whence, if the subduction of stimulus has not been too great, so as to impair the health of the part, the activity of the irritative motions returns, even though the stimulus continues less than usual; and those of the associate motions become considerably increased, because these latter are now excited by the previous fibrous motions, which now act as strong or stronger than formerly, and have also acquired an accumulation of the sensorial power of association. This accounts for the curious event of our becoming warm in a minute or two after remaining in water of about 80 degrees of heat, as in the bath at Buxton; or in the cold air of a frosty morning of about 30 degrees of heat.

But if the parts thus possessed of the accumulated sensorial powers of irritation and of association be exposed again to their natural quantity of stimulus, a great excess of activity supervenes; because the fibres, which possess accumulated irritation, are now excited by

by their usual quantity of stimulus ; and those which possess accumulated association, are now excited by double or treble the quantity of the preceding irritative fibrous motions, with which they are catenated ; this constitutes the hot fit of fever.

Another important circumstance occurs, when the parts, which are torpid from decreased stimulus, do not accumulate a quantity of sensorial power sufficient for the purpose of renewing their own natural quantity of action ; but are nevertheless not so torpid, as to have the life of the part impaired. In this situation the superabundance of the accumulated power of irritation contributes to actuate the associate motions next catenated with them. Thus, when a person breathes air with less oxygene than natural, as by covering his head in bed, and thus respiring the same atmosphere repeatedly, the heart and arteries become less active by defect of the stimulus of oxygene ; and then the accumulation of sensorial power of irritation becomes instantly very great, as these organs are subject to perpetual and energetic action. This accumulation nevertheless is not so great as to renew their own activity under this defect of stimulus, but yet is in sufficient abundance to increase the associability of the next link of catenation, that is, to actuate the capillaries of the skin with great and perpetual increase of energy. This resembles continued fever with weak pulse ; in which the accumulation of the sensorial power caused by the lessened motions of the heart and arteries, actuates the capillaries with increase of energy.

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3. When the accumulation of the sensorial power of association, which is caused as above explained by deficient excitement owing to the lessened quantity of action of the irritative fibrous motions, with which the associate train is catenated, is not in quantity sufficient to renew the natural actions of the first link of an associate train of motions; it is nevertheless frequently so abundant as to actuate the next link of the associated train with unnatural energy by increasing its associability; and that in a still greater degree if that second link of the associated train was previously in a torpid state, that is, had previously acquired some accumulation of the sensorial power of association. This important circumstance of the animal economy is worthy our most accurate attention. Thus if the heart and arteries are deprived of their due quantity of the stimulus of oxygen in the blood, a weak and quick pulse ensues, with an accumulation of the sensorial power of irritation; next follows an increase of the action of the capillaries by the superabundance of this accumulated power of irritation; but there also exists an accumulation of the power of association in these acting capillaries, which is not now excited by the deficient actions of the heart and arteries; but which by its abundance contributes to actuate the next link of association, which is the sick stomach in the case related from Sydenham in Class IV. 1. 1. 2. and explained in this Supplement I. 4. And as this sick stomach was in a previous state of torpor, it might at the same time possess an accumulation of some sensorial power,

power, which, if it was of association, would be thus more powerfully excited by the increased actions of the capillaries; which existed in consequence of the weak action of the heart and arteries. This also resembles in some respects the continued fevers with weak pulse, and with increased activity of the capillaries.

4. When a torpor of some irritative motions occurs from a previous exhaustion of the sensorial power of irritation by the action of some very great stimulus, it is long before any accumulation of the sensorial power of irritation is produced; as is experienced in the sickness and languor, which continues a whole day after a fit of drunkenness. But nevertheless there occurs an accumulation of the sensorial power of association in the first link of the associate train of motions, which is catenated with these torpid irritative ones; which accumulation is owing to deficient excitement of that sensorial power in the first link of the associate train. This first link therefore exists also in a less active or torpid state, but the accumulation of the sensorial power of association by its superabundance contributes to actuate the second link of the associate train with unnatural quantity of motion; and that though its own natural quantity of the power of association is not excited by the deficient action of preceding fibrous motions.

When this happens to the stomach, as after its irritative motions have been much exerted from the un-
natural

natural stimulus of wine, or opium, or of contagious matter mixed with the saliva, a torpor or inactivity of it succeeds for a greater or less length of time; as no accumulation of the sensorial power of irritation can occur, till the natural quantity, which has been previously expended, is first restored. Then the heart and arteries, which are next in catenation, become less active from the want of sufficient excitement of the sensorial power of association, which previously contributed to actuate them. This sensorial power of association therefore becomes accumulated, and by its superabundance contributes to actuate the link next in association, which has thus acquired so great a degree of associability, as to overbalance the less quantity of the excitement of it by the torpid action of the previous or first associate link. This happens to the capillaries, when the heart and arteries are affected as above by the torpor of the stomach, when it is occasioned by previous great expenditure of its sensorial power, and thus constitutes fever with weak pulse, which is here termed *inirritative fever*, *typhus mitior*.

5. When a deficiency of stimulus is too great or too long continued, so as to impair the life of the part, no further accumulation of sensorial power occurs; as when the skin is long exposed to cold and damp air. In that case the link in catenation, that is, the first of the associate train, is rendered torpid by defect of excitement of its usual quantity of the sensorial power of association, and from there being no accumulation of the

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the sensorial power of irritation to increase its associability, and thus to contribute to actuate it by overbalancing the defect of the excitement of its association.

Thus on riding long and slowly on a cold and damp day, the exhalation of the vapour, which is impinged on the skin, as the traveller proceeds, carries away his warmth faster, than it is generated within the system; and thus the capillaries of the skin have their actions so much impaired after a time, that no accumulation of the sensorial power of irritation occurs; and then the stomach, whose motions are connected with those of the capillaries, ceases to act from the deficient excitement of the power of association; and indigestion and flatulency succeed, instead of the increased digestion and hunger, which occur, when the cutaneous capillaries are exposed to a less degree of cold, and for a shorter time. In which latter situation the accumulation of the sensorial power of irritation increases by its superabundance the associability of the fibres of the stomach, so as to overbalance the defect of the excitement of their association.

6. The stomach is affected secondarily in fevers with strong pulse, as in those with weak pulse it is affected primarily. To illustrate this doctrine I shall relate the following case of Mr. Y———. He was a young man rather intemperate in the use of wine or beer, and was seized with a cold fit, and with a consequent hot one with strong pulse; on examining his hypo-

chondrium an oblong tumour was distinctly felt on the left side of the stomach, which extended six or eight inches downward, and was believed to be a tumour of the spleen, which thus occasioned by its torpor the cold fit and consequent hot fit of fever with strong pulse. This fever continued, though with remissions, for two or three weeks; and the patient repeatedly lost blood, used cathartics with calomel and senna, and had frequent antimonial and saline medicines. And after he was much weakened by evacuations, the Peruvian bark and small doses of steel removed the fever, but the tumour remained many years during the remainder of his life.

In this case the tumour of the spleen was occasioned by the torpor of the absorbent vessels; while the secreting vessels continued somewhat longer to pour their fluids into the cells of it. Then the inactivity of this viscus affected the whole system with torpor by the deficient excitement of the sensorial power of association, which contributes along with the irritation caused by their specific stimuli to actuate the whole sanguiferous, secreting, and absorbent vessels; and along with these the stomach, which possesses perhaps greater mobility, or promptitude to torpor or to orgasm, than any other part. And after a time all these parts recover their actions by the accumulation of their sensorial power of association. But the spleen not recovering its action from the accumulation of its power of irritation, as appeared from the continuance of the tumour, still affects the stomach by
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its defective irritative motions ceasing to excite the association, which ought to contribute to actuate it.

Hence the stomach continues torpid in respect to its motions, but accumulates its power of association; which is not excited into action by the defective motions of the spleen; this accumulation of the sensorial power of association now by its superabundance actuates the next link of associate motions, which consists of the heart and arteries, into greater energy of action than natural, and thus causes fever with strong pulse; which, as it was supposed to be most frequently excited by increase of irritation, is called irritative fever or synocha.

Similar to this in the small-pox, which is given by inoculation, the stomach is affected secondarily, when the fever commences; and hence in this small-pox the pulsations of the heart and arteries are frequently stronger than natural, but never weaker, for the reasons above given. Whereas in that small-pox, which is caused by the stomach being primarily affected, by the contagious matter being swallowed with the saliva, whether the tonsils are at the same time affected or not, the pulsations of the heart and arteries become weak, and the inirritative fever is produced, as explained above, along with the confluent small-pox. This unfolds the cause of the mildness of the inoculated small-pox; because in this disease the stomach is affected secondarily, whereas in the natural small-pox it is frequently affected primarily by swallowing the contagious matter mixed with saliva.

In the measles I suppose the contagious matter to be dissolved in the air, and therefore not liable to be mixed with the saliva; whereas the variolous matter is probably only diffused in the air, and thence more readily mixed with the saliva in the mouth during respiration. This difference appears more probable, as the small-pox I believe is always taken at a less distance from the diseased person than is necessary to acquire the measles. The contagion of the measles affects the membranes of the nostrils, and the secretion of tears in consequence, but never I suspect the stomach primarily, but always secondarily; whence the pulsation of the heart and arteries is always stronger than natural, so as to bear the lancet at any period of the disease.

The great mildness sometimes, and fatality at other times, of the scarlet fever may depend on the same circumstance; that is, on the stomach being primarily or secondarily affected by the contagious matter, observing that the tonsils may be affected at the same time with the stomach. Should this prove to be the case, which future observations must determine, what certain advantage must arise from the inoculation of this disease! When it is received by the skin primarily I suppose no sore throat attends it, nor fever with weak pulse; when it is received by the stomach primarily, the tonsils are affected at the same time, and the torpor of the stomach produces irritative fever, and the mortification of the tonsils succeeds.

We may hence conclude, that when the torpor of the stomach is either owing to defect of stimulus, which is not so great as to impair the life of the part, as in moderate hunger, or in swallowing iced water, or when its torpor is induced by its catenation or association with other torpid parts, as in the commencement of intermittent fevers, and inoculated small-pox, that the subsequent action of the heart and arteries is generally increased, producing irritative fever. Which is owing to the accumulation of the sensorial power of irritation in one case, and of association in the other, contributing to actuate the next link of the catenated or associated motions. But when the torpor of the stomach is induced by previous exhaustion of its sensorial powers of irritation or of association by continued violent action, as by the stimulus of digitalis, or of contagious matter, or after intoxication from wine or opium, a weaker action of the heart and arteries succeeds, because there is no accumulation of sensorial power, and a deficient excitement of association. And finally, as this weak action of the heart and arteries is not induced by exhaustion of sensorial power, but by defect of the excitement of association, the accumulation of this power of association increases the action of the capillaries, and thus induces irritative fever.

7. When any part of the system acts very violently in fevers, the sensorial power of sensation is excited, which increases the actions of the moving system;

whereas the pain, which arises from decreased irritative motions, as in hemicrania, seems to exhaust a quantity of sensorial power, without producing or increasing any fibrous actions.

When the stomach is primarily affected, as in irritative fevers from contagion, and in such a manner as to occasion pain, the action of the capillaries seems to be increased by this additional sensorial power of sensation, whence extensive inflammation or mortification; but when the stomach and consequently the heart and arteries continue their torpidity of action; as in confluent small-pox, and fatal scarlatina; this constitutes sensitive irritative fever, or typhus gravior.

But when the stomach is secondarily affected, if the sensorial power of sensation is excited, as in pleurisy or peripneumony, the actions of the heart and arteries, are violently increased, and of all the moving system along with them. Thus the peripneumony is generally induced by the patient respiring very cold air, and this especially after being long confined to warm air, or after being much fatigued and heated by excessive labour or exercise. For we can cover the skin with more clothes, when we feel ourselves cold; but the lungs not having the perception of cold, we do not think of covering them; nor have the power to cover them, if we desired it; and the torpor, thus produced is greater, or of longer duration, in proportion to the previous expenditure of sensorial power by heat or exercise.

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This torpor of the lungs affects the skin with shuddering, and the stomach is also secondarily affected; next follows the violent action of the lungs from the accumulation of the power of irritation, and an inflammation of them follows this violent action. While the stomach recovers its activity by the increase of the excitement of the sensorial power of association, and along with it the heart and arteries, and the whole moving system. Hence this inflammation occurs during the hot fit of fever, and no cold fit succeeds, because the excess of the sensorial power of sensation prevents a succeeding torpor.

These new motions of certain parts of the system produce increased secretions of nutritious or organic mucus, which forms new vessels; these new vessels by their unusual motions produce new kinds of fluids; which are termed contagious, because they have the power, when introduced into a healthy body, of producing similar actions and effects, with or without fever, as in the small-pox and measles, or in the itch and venereal disease.

If any of these contagious matters affect the stomach with torpor either by their stimulus immediately applied, or by its sympathy with the parts first diseased, a fever is produced with sickness and want of appetite; as in small-pox, and scarlatina. If the stomach is not affected by contagious matter, no fever succeeds, as in itch, tinea, syphilis.

All these contagious matters are conceived to be harmless, till they have been exposed to the air, either

openly or through a moist membrane; from which they are believed to acquire oxygene, and thence to become some kind of animal acids. As the preparations of mercury cure venereal ulcers; as a quarter of a grain of sublimate dissolved in wine, and given thrice a day; this effect seems to be produced either by its stimulating the absorbents in the ulcer to absorb the venereal matter before it has acquired oxygen; or by afterwards uniting with it chemically, and again depriving it of its acquired acidity. On either supposition it might probably be given with advantage in small-pox, and in all infectious diseases, both previous to their commencement, and during their whole progress.

8. The cold fits of intermittent fevers are caused by the torpor of some part owing to deficient irritation, and of the other parts of the system from deficient association. The hot fits are owing first to the accumulation of irritation in the part primarily affected, if it recovers its action, which does not always happen; and secondly to the accumulation of association in the other parts of the system, which during health are subject to perpetual action; and lastly also to the greater excitement of the power of association, when the part primarily affected recovers its irritability, and acts with greater energy than natural.

The deficient secretions in the cold fit depend on the torpor of the glandular system; and the increased secretions in the hot fit on their more energetic action.

The

The thirst in the cold fit is owing to the deficient absorption from the skin, cellular membrane, and bladder; the thirst in the hot fit is owing to the too great dissipation of the aqueous part of the blood. The urine is pale and in small quantity in the cold fit from deficient secretion of it, and from deficient absorption of its aqueous parts; it is high coloured, and sometimes deposits a sediment, in the hot fit from the greater secretion of it in the kidneys, and the greater absorption of its aqueous and saline part in the bladder. The dryness and scurf on the tongue and nostrils is owing to the increased heat of the air expired from the lungs, and consequent greater evaporation of the aqueous part of the mucus. The sweats appear in consequence of the declension of the hot fit, owing to the absorbent vessels of the skin losing their increased action sooner than the secreting ones; and to the evaporation lessening as the skin becomes cooler. The returns of the paroxysms are principally owing to the torpor of some less essential part of the system remaining after the termination of the last fit; and are also dependent on solar or lunar diurnal periods.

The torpor of the part, which induces the cold paroxysm, is owing to deficient irritation occasioned either by the subduction of the natural stimuli of food, or water, or pure air, or by deficiency of external influences, as of heat, or of solar or lunar gravitation. Or secondly, in consequence of the exhaustion of sensorial power by great previous exertions of some parts

of the system, as of the limbs by great labour or exercise, or of the stomach by great stimulus, as by contagious matter swallowed with the saliva, or by much wine or opium previously taken into it. Or lastly a torpor of a part may be occasioned by some mechanic injury, as by a compression of the nerves of the part, or of their origin in the brain; as the sitting long with one leg crossed over the other occasions numbness, and as a torpor of the stomach with vomiting frequently precedes paralytic strokes of the limbs.

As sleep is produced, either by defect of stimulus, or by previous exhaustion of sensorial power; so the accumulation of the sensorial power of volition in those muscles and organs of sense, which are generally obedient to it, awakens the sleeping person; when it has increased the quantity of voluntariness so much as to overbalance the defect of stimulus in one case, and the exhaustion of sensorial power in the other; which latter requires a much longer time of sleep than the former. So the cold paroxysm of fever is produced either by defect of stimulus, or by previous exhaustion of the sensorial power of some part of the system; and the accumulation of the sensorial power of irritation in that part renews the action of it, when it has increased its irritability so much as to overbalance the defect of stimulus in one case, and the exhaustion of sensorial power in the other; which latter requires a much longer torpor or cold fit than the former,

But

But in the cold paroxysm of fever besides the torpor of one part of the system from defect of irritation, the remainder of it becomes torpid owing to defect of excitement of the sensorial power of association by the lessened action of the part first affected. This torpor of the general system remains, till the accumulation of the sensorial power of association has increased the associability so much as to overbalance the defect of the excitement of association; then the torpor ceases, and if the first affected part has recovered its activity the other parts are all thrown into excess of action by their increased associability, and the hot fit of fever is produced.

9. In the continued fevers with strong pulse the stomach is affected secondarily, and thus acts feebly from deficient excitement of the power of association; but the accumulation of the power of association thus produced in an organ subject to perpetual and energetic action, is so great as to affect the next link of the associate train, which consists of the heart and arteries; these therefore are exerted perpetually with increase of action.

In continued fevers with weak pulse the torpid stomach is affected primarily by previous exhaustion of its irritability by stimulus, as of contagious matter swallowed into it. The heart and arteries act feebly from deficient excitement of the power of association, owing to the torpor of the stomach, with which they are catenated; but the accumulation of the power of
association,

affociation, thus produced in organs subject to perpetual and energetic motion, is so great, as to affect the next link of the affociate train; which consists of the capillaries of the skin or other glands; these therefore are exerted perpetually with great increase of action.

The continued fevers with strong pulse terminate by the reduction or exhaustion of the sensorial power by violent action of the whole system; which is followed either by return of health with the natural quantity of irritability, and of affociability, or by a total destruction of them both, and consequent death.

In continued fevers with weak pulse the stomach remains torpid during the whole course of the fever; and at length by the recovery of its irritability and sensibility effects the cure of it. Which generally happens about the first, second, or third quarter of the lunar period, counted from the commencement of the disease, or continues a whole lunation, and sometimes more; which gave rise to what are termed critical days. See Sect. XXXVI. 4. on this subject. If the stomach does not recover from its torpor, the patient becomes emaciated, and dies exhausted by the continuance of the increased action of the capillaries and absorbents, and the want of nourishment,

The cure of continued fever with weak pulse consists first in weakening the undue action of the capillaries of the skin by ablution with cold water from 32 to 80 degrees of heat; or by exposing them to cool air. Secondly by invigorating the actions of the stomach,

mach, by decreasing them for a time, and thence accumulating the power of irritation, as by an emetic, or by iced water, or iced wine. Or by increase of stimulus, as by bark, wine, opium, and food, in small quantities frequently repeated. Or by renewing the action of the stomach by slight electric shocks. Or by fomenting it frequently with water heated to 96 or 100 degrees. Or lastly by exciting its power of association with other parts of the system, as by a blister; which succeeds best when the extremities are cool; or by swinging, as in vertigo rotatoria.

If by the stimulus of the Peruvian bark on the fibres of the stomach, they regain their due action, the heart and arteries also regain their due action; as their sensorial power of association is now excited, and expended as usual. And as there is then no accumulation of sensorial power in the heart and arteries, the capillaries cease to act with too great energy, and the fever is cured.

Thirdly, If the heart and arteries could be themselves stimulated into greater action, although the stomach remained torpid, they might probably by expending a greater quantity of sensorial power of irritation, prevent an accumulation of the sensorial power of association, (for these may possibly be only different modes of action of the spirit of animation,) and thus the too great action of the capillaries might be prevented and the fever cease. This new mode of cure might possibly be accomplished, if the patient was to breathe a gallon or two of pure or diluted oxygen

gas frequently in a day ; which by passing through the moist membranes of the lungs and uniting with the blood might render it more stimulant, and thus excite the heart and arteries into greater action.

Fourthly. Greater energy might probably be given to the whole system, and particularly to those parts which act too feebly in fevers, as the stomach and the heart and arteries, if the action of the secreting vessels of the brain could be increased in energy ; this is probably one effect of all those drugs, which when given in large quantity induce intoxication, as wine and opium. And when given with great caution in small quantities uniformly repeated, as from three drops to five of the tincture of opium, but not more, every six hours, I believe they supply an efficacious medicine in fevers with great arterial debility ; and the more so, if the Peruvian bark be exhibited alternately every six hours along with them. There are other means of exciting the vessels of the brain into action ; as first by decreasing the stimulus of heat by temporary cold fomentation ; secondly, increasing the stimulus of heat by long continued warm fomentation ; thirdly, by electricity, as very small shocks passed through it in all directions ; and lastly by blisters on the head. All those require to be used with great caution, and especially where there exists an evident stupor, as the removing of that is I believe frequently injurious. See stupor, Class I. 2. 5. 10.

The cure of fever with strong pulse consists in the repeated use of venesection, gentle cathartics, diluents ;
medicines

medicines producing sickness, as antimonials, digitalis; or the respiration of carbonated hydrogen; or by respiration of atmospheric air lowered by a mixture of hydrogen, azote, or carbonic acid gas, or by compressing the brain by whirling in a decumbent posture, as if lying across an horizontal mill-stone. See the former parts of this supplement for the methods of cure both of fevers with strong and weak pulse.

10. When any difficulty occurs in determining the weak pulse from the strong one, it may generally be assisted by counting its frequency. For when an adult patient lies horizontally in a cool room, and is not hurried or alarmed by the approach of his physician, nor stimulated by wine or opium, the strong pulse seldom exceeds 118 or 120 in a minute; and the weak pulse is generally not much below 130, and often much above that number, except when the patient has naturally a pulse slower than usual in his healthy state. Secondly in sitting up in bed, or changing the horizontal to a perpendicular posture, the quickness of the weak pulse is liable immediately to increase 10 or 20 pulsations in a minute, which does not I believe occur in the strong pulse, when the patient has rested himself after the exertion of rising.

XVII. *Conclusion.*

Thus have I given an outline of what may be termed the sympathetic theory of fevers, to distinguish it

it from the mechanic theory of Boerhaave, the spasmodic theory of Hoffman and of Cullen, and the putrid theory of Pringle. What I have thus delivered, I beg to be considered rather as observations and conjectures, than as things explained and demonstrated; to be considered as a foundation and a scaffolding, which may enable future industry to erect a solid and a beautiful edifice, eminent both for its simplicity and utility, as well as for the permanency of its materials,—which may not moulder, like the structures already erected, into the sand of which they were composed; but which may stand unimpaired, like the Newtonian philosophy, a rock amid the waste of ages!

ADDITIONS.

ADDITIONS,

ADDITION I.

*At the end of the article Canities, in Class I. 2.
2. 11. please to add the following :*

As mechanical injury from a percussion, or a wound, or a caustic, is liable to occasion the hair of the part to become grey ; so I suspect the compression of parts against each other of some animals in the womb is liable to render the hair of those parts of a lighter colour ; as seems often to occur in black cats and dogs. A small terrier bitch now stands by me, which is black on all those parts, which were external, when she was wrapped up in the uterus, *teres atque rotunda* ; and those parts white, which were most constantly pressed together ; and those parts tawny, which were generally but less constantly pressed together. Thus the hair of the back from the forehead to the end of the tail is black, as well as that of the sides, and external parts of the legs, both before and behind.

As in the uterus the chin of the whelp is bent down, and lies in contact with the fore part of the neck and breast ; the tail is applied close against the division of the thighs behind ; the inside of the hinder thighs are pressed close to the sides of the belly, all these parts have white hairs.

The

The fore-legs in the uterus lie on each side of the face; so that the feet cover part of the temples, and compress the prominent part of the upper eye-brows, but are so placed as to defend the eye-balls from pressure; it is curious to observe, that the hair of the sides of the face, and of the prominent upper eye-brows, are tawny, and of the inside of the feet and legs, which covered them; for as this posture admitted of more change in the latter weeks of gestation, the colour of these parts is not so far removed from black, as of those parts, where the contact or compression was more uniform.

Where this uterine compression of parts has not been so great as to render the hair white in other animals, it frequently happens, that the extremities of the body are white, as the feet, and noses, and tips of the ears of dogs and cats and horses, where the circulation is naturally weaker; whence it would seem, that the capillary glands, which form the hair, are impeded in the first instance by compression, and in the last by the debility of the circulation in them. See Class I. 1. 2. 15.

This day, August 8th, 1794, I have seen a negro, who was born (as he reports) of black parents, both father and mother, at Kingston in Jamaica, who has many large white blotches on the skin of his limbs and body; which I thought felt not so soft to the finger, as the black parts. He has a white divergent blaze from the summit of his nose to the vertex of his head; the upper part of which, where it extends on the hairy scalp,

has thick curled hair, like the other part of his head, but quite white. By these marks I supposed him to be the same black, who is described, when only two years old, in the Transactions of the American Philosophical Society, Vol. II. page 292, where a female one is likewise described with nearly similar marks.

The joining of the frontal bones, and the bregma, having been later than that of the other sutures of the cranium, probably gave cause to the whiteness of the hair on these parts by delaying or impeding its growth.

ADDITION II.

The following extract from a letter of Dr. Beddoes on hydrocephalus internus, I esteem a valuable addition to the article on that subject at Class I. 2. 3. 12.

“ Master L——, aged 9 years, became suddenly ill in the night about a week before I saw him. On the day before the attack, he had taken opening medicines, and had bathed afterwards. He had complained of violently acute pain in his head, shrieked frequently, ground his teeth hard, could not bear to have his head raised from the pillow, and was torpid or deaf. His tongue was white, pulse 110 in the evening and full. As yet the pupil of the eye was irritable, and he had no strabismus. He had been bled with leeches about the head, and blistered. I

directed mercurial inunction, and calomel from 3 to 6 grains to be taken at first every six, and afterwards every three hours. This plan produced no sensible effect, and the patient died on the 18th day after the seizure. He had convulsion fits two days preceding his death, and the well-known symptoms of hydrocephalus internus all made their appearance. From what I had seen and read of this disease, I believed it to belong to inflammations, and at an earlier period I should be tempted to bleed as largely as for pneumonia. The fluid found after death in the ventricles of the brain I impute to debility of the absorbents induced by inflammation. My reasons are briefly these; 1. The acuteness of the pain. 2. The state of the pulse. In the above case for the first 9 or 10 days it did not exceed 110, and was full and strong. 3. To find out whether any febrile alternations took place, Master L.'s feet were frequently felt, and they were found at times cold, and at other times of a dry heat. I have many times seen this disease, but the patients were too young, or too far advanced, to inform me, whether they had chillness succeeded by heat at its onset. 4. The disorders to which the young are more peculiarly liable afford a presumption, that hydrocephalus internus is an inflammatory disease; and this is confirmed by the regularity of the period, within which it finishes its course. And lastly, does it not happen more frequently than is suspected from external injury?

I have just now been well informed, that Dr. Rush has lately cured five out of six patients by copious bleedings.

bleedings. I relate here the reasons for an opinion without pretending to a discovery. Something like this doctrine may be found in certain modern publications, but it is delivered in that vague and diffuse style, which I trust your example will banish from medical literature.”

Clifton, near Bristol, }
 July 28, 1795. }

To this idea of Dr. Beddoes may be added, that the hydrocele generally succeeds an injury, and consequent inflammation of the bag, which contains it. And that other dropsies, which principally attend inebriates, are consequent to too great action of the mucous membranes by the stimulus of beer, wine, and spirits. And lastly, that as these cases of hydrocephalus end so fatally, a new mode of treating them is much to be desired, and deserves to be seriously attended to.

ADDITION III. ON VERTIGO.

*To be placed after the additional Note at the end of Vol.
 I. on this Subject.*

Having reperused the ingenious Essay of Dr. Wells on Single Vision, and his additional observations in the Gentleman's Magazine on the apparent retrogression of objects in vertigo, I am induced to believe, that this apparent retrogression of objects is not always owing to the same cause.

When

When a person revolves with his eyes closed, till he becomes vertiginous, and then stands still without opening them, he seems for a while to go forward in the same direction. This hallucination of his ideas cannot be owing to ocular spectra, because, as Dr. Wells observes, no such can have been formed; but it must arise from a similar continuance or repetition of ideas belonging to the sense of touch, instead of to the sense of vision; and should therefore be called a tangible, not a visual, vertigo. In common language this belief of continuing to revolve for some time, after he stands still, when a person has turned round for a minute-in the dark, would be called a deception of imagination.

Now at this time if he opens his eyes upon a gilt book, placed with other books on a shelf about the height of his eye, the gilt book seems to recede in the contrary direction; though his eyes are at this time kept quite still, as well as the gilt book. For if his eyes were not kept still, other books would fall on them in succession; which, when I repeatedly made the experiment, did not occur; and which thus evinces, that no motion of the eyes is the cause of the apparent retrocession of the gilt book. Why then does it happen?—Certainly from an hallucination of ideas, or in common language the deception of imagination.

The vertiginous person still imagines, that he continues to revolve forwards, after he has opened his eyes; and in consequence that the objects, which his eyes happen to fall upon, are revolving backward;

as they would appear to do, if he was actually turning round with his eyes open. For he has been accustomed to observe the motions of bodies, whether apparent or real, so much more frequently by the eye than by the touch; that the present belief of his gyration, occasioned by the hallucinations of the sense of touch, is attended with ideas of such imagined motions of visible objects, as have always accompanied his former gyrations, and have thus been associated with the muscular actions and perceptions of touch, which occurred at the same time.

When the remains of colours are seen in the eye, they are termed ocular spectra; when remaining sounds are heard in the ear, they may be called auricular murmurs; but when the remaining motions, or ideas, of the sense of touch continue, as in this vertigo of a blind-folded person, they have acquired no name, but may be termed evanescent titillations, or tangible hallucinations.

Whence I conclude, that vertigo may have for its cause either the ocular spectra of the sense of vision, when a person revolves with his eyes open; or the auricular murmurs of the sense of hearing, if he is revolved near a cascade; or the evanescent titillations of the sense of touch, if he revolves blindfold. All these I should wish to call vanishing ideas, or sensual motions, of those organs of sense; which ideas, or sensual motions, have lately been associated in a circle, and therefore for a time continue to be excited. And what are the ideas of colours, when they are excited

by imagination or memory, but the repetition of finer ocular spectra? What the idea of sounds, but the repetition of finer auricular murmurs? And what the ideas of tangible objects, but the repetition of finer evanescent titillations?

The tangible, and the auricular, and the visual vertigo, are all perceived by many people for a day or two after long travelling in a boat or coach; the motions of the vessel, or vehicle, or of the surrounding objects, and the noise of the wheels and oars, occur at intervals of reverie, or at the commencement of sleep. See Sect. XX. 5. These ideas, or sensual motions, of sight, of hearing, and of touch, are succeeded by the same effects as the ocular spectra, the auricular murmurs, and the evanescent titillations above mentioned; that is, by a kind of vertigo, and cannot in that respect be distinguished from them. Which is a further confirmation of the truth of the doctrine delivered in Sect. III. of this work, that the colours remaining in the eyes, which are termed ocular spectra, are ideas, or sensual motions, belonging to the sense of vision, which for too long a time continue their activity.

ADDITION IV. OF VOLUNTARY MOTIONS.

A correspondent acquaints me, that he finds difficulty in understanding how the convulsions of the limbs in epilepsy can be induced by voluntary exertions. This I suspect first to have arisen from the double

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ble meaning of the words “ involuntary motions ;” which are sometimes used for those motions, which are performed without the interference of volition, as the pulsations of the heart and arteries ; and at other times for those actions, which occur, where two counter volitions oppose each other, and the stronger prevails ; as in endeavouring to suppress laughter, and to stop the shudderings, when exposed to cold. Thus when the poet writes,

———video meliora, proboque,
Deteriora sequor.———

The stronger volition actuates the system, but not without the counteraction of unavailing smaller ones ; which constitute deliberation.

A second difficulty may have arisen from the confined use of the words “ to will,” which in common discourse generally mean to choose after deliberation ; and hence our will or volition is supposed to be always in our own power. But the will or voluntary power, acts always from motive, as explained in Sect. XXXIV. 1. and in Class IV. 1. 3. 2. and III. 2. 1. 12. which motive can frequently be examined previous to action, and balanced against opposite motives, which is called deliberation ; at other times the motive is so powerful as immediately to excite the sensorial power of volition into action, without a previous balancing of opposite motives, or counter volitions. The former of these volitions is exercised in the common purposes of life, and the latter in the exertions of epilepsy and insanity.

It is difficult *to think without words*, which however all those must do, who discover new truths by reasoning; and still more difficult, when the words in common use deceive us by their twofold meanings, or by the inaccuracy of the ideas, which they suggest.

ADDITION V. OF FIGURE.

I feel myself much obliged by the accurate attention given to the First Part of Zoonomia, and by the ingenious criticisms bestowed on it, by the learned writers of that article both in the Analytical and English Reviews. Some circumstances, in which their sentiments do not accord with those expressed in the work, I intend to reconsider, and to explain further at some future time. One thing, in which both these gentlemen seem to dissent from me, I shall now mention, it is concerning the manner, in which we acquire the idea of figure; a circumstance of great importance in the knowledge of our intellect, as it shews the cause of the accuracy of our ideas of motion, time, space, number, and of the mathematical sciences, which are concerned in the mensurations or proportions of figure.

This I imagine may have in part arisen from the prepossession, which has almost universally prevailed, that ideas are immaterial beings, and therefore possess no properties in common with solid matter, which I suppose to be a fanciful hypothesis, like the stories of ghosts and apparitions, which have so long amused,

amused, and still amuse, the credulous without any foundation in nature.

The existence of our own bodies, and of their solidity, and of their figure, and of their motions, is taken for granted in my account of ideas; because the ideas themselves are believed to consist of motions or configurations of solid fibres; and the question now proposed is, how we become acquainted with the figures of bodies external to our organs of sense? Which I can only repeat from what is mentioned in Sect. XIV. 2. 2. that if part of an organ of sense be stimulated into action, as of the sense of touch, that part so stimulated into action must possess figure, which must be similar to the figure of the body, which stimulates it.

Another previous prepossession of the mind, which may have rendered the manner of our acquiring the knowledge of figure less intelligible, may have arisen from the common opinion of the perceiving faculty residing in the head; whereas our daily experience shews, that our perception (which consists of an idea, and of the pleasure or pain it occasions) exists principally in the organ of sense, which is stimulated into action; as every one, who burns his finger in the candle, must be bold to deny.

When an ivory triangle is pressed on the palm of the hand, the figure of the surface of the part of the organ of touch thus compressed is a triangle, resembling in figure the figure of the external body, which compresses it. The action of the stimulated fibres,
which

which constitute the idea of hardness and of figure, remains in this part of the sensorium, which forms the sense of touch; but the sensorial motion, which constitutes pleasure or pain, and which is excited in consequence of these fibrous motions of the organ of sense, is propagated to the central parts of the sensorium, or to the whole of it; though this generally occurs in less degree of energy, than it exists in the stimulated organ of sense; as in the instance above mentioned of burning a finger in the candle.

Some, who have espoused the doctrine of the immateriality of ideas, have seriously doubted the existence of a material world, with which only our senses acquaint us; and yet have assented to the existence of spirit, with which our senses cannot acquaint us; and have finally allowed, that all our knowledge is derived through the medium of our senses! They forget, that if the spirit of animation had no properties in common with matter, it could neither affect nor be affected by the material body. But the knowledge of our own material existence being granted, which I suspect few rational persons will seriously deny, the existence of a material external world follows in course; as our perceptions, when we are awake and not insane, are distinguished from those excited by sensation, as in our dreams, and from those excited by volition or by association as in insanity and reverie, by the power we have of comparing the present perceptions of one sense with those of another, as explained in Sect. XIV. 2. 5. And also by comparing
the

the tribes of ideas, which the symbols of pictures, or of languages, suggest to us, by intuitive analogy with our previous experience, that is, with the common course of nature. See Class III. 2. 2. 3. on Credulity.

A D D I T I O N VI.

Please to add the following at the end of page 14.

Cold and hot Fit.

As the torpor, with which a fit of fever commences, is sometimes owing to defect of stimulus, as in going into the cold-bath; and sometimes to a previous exhaustion of the sensorial power by the action of some violent stimulus, as after coming out of a hot room into cold air; a longer time must elapse, before there can be a sufficient accumulation of sensorial power to produce a hot fit in one case than in the other. Because in the latter case the quantity of sensorial power previously expended must be supplied, before an accumulation can begin.

The cold paroxysm commences, when the torpor of a part becomes so great, and its motions in consequence so slow or feeble, as not to excite the sensorial power of association; which in health contributes to move the rest of the system, which is catedenated with it. And the hot fit commences by the accumulation of the sensorial power of irritation of the part first affected, either so as to counteract its deficient

deficient stimulus, or its previous waste of sensorial power; and it becomes general by the accumulation of the sensorial power of association; which is excited by the renovated actions of the part first affected; or becomes so great as to overbalance the deficient excitement of it. On all these accounts the hot fit cannot be supposed to bear any proportion to the cold one in length of time, though the latter may be the consequence of the former. See Suppl. I. 16. 8.

ADDITION VII. ON WARMTH.

To be added at the end of the Species Sudor Calidus, in Class I. 1. 2. 3.

WHEN the heat of the body in weak patients in fevers is increased by the stimulus of the points of flannel, a greater consequent debility succeeds, than when it is produced by the warmth of fire; as in the former the heat is in part owing to the increased activity of the skin, and consequent expenditure of sensorial power; whereas in the latter case it is in part owing to the influx of the fluid matter of heat.

So the warmth produced by equitation, or by rubbing the body and limbs with a smooth brush or hand, as is done after bathing in some parts of the East, does not expend nearly so much sensorial power, as when the warmth is produced by the locomotion of the whole weight of the body by muscular action, as in walking, or running, or swimming. Whence the warmth of a fire is to be preferred to flannel shirts
for

for weak people, and the agitation of a horse to exercise on foot. And I suppose those, who are unfortunately lost in snow, who are on foot, are liable to perish sooner by being exhausted by their muscular exertions; and might frequently preserve themselves by lying on the ground, and covering themselves with snow, before they were too much exhausted by fatigue. See Botan. Garden, Vol. II the note on Barometz.

ADDITION VIII. PUERPERAL FEVER.

To be added to Class II. 1. 6. 16.

A very interesting account of the puerperal fever, which was epidemic at Aberdeen, has been lately published by Dr. Alexander Gordon. (Robinson, London.) In several dissections of those, who died of this disease, purulent matter was found in the cavity of the abdomen; which he ascribes to an erysipelatous inflammation of the peritonæum, as its principal seat, and of its productions, as the omentum, mesentery, and peritonæal coat of the intestines.

He believes, that it was infectious, and that the contagion was always carried by the accoucheur or the nurse from one lying-in woman to another.

The disease began with violent unremitting pain of the abdomen on the day of delivery, or the next day, with shuddering, and very quick pulse, often 140 in a minute. In this situation, if he saw the patient within 12 or 24 hours of her seizure, he took away
from

from 16 to 24 ounces of blood, which was always fizy. He then immediately gave a cathartic consisting of three grains of calomel, and 40 grains of powder of jalap. After this had operated, he gave an opiate at night; and continued the purging and the opiate for several days.

He asserts, that almost all those, whom he was permitted to treat in this manner early in the disease, recovered to the number of 50; and that almost all the rest died. But that when two or three days were elapsed, the patient became too weak for this method; and the matter was already formed, which destroyed them. Except that he saw two patients, who recovered after discharging a large quantity of matter at the navel. And a few, who were relieved by the appearance of external erysipelas on the extremities.

This disease, consisting of an erysipelatous inflammation, may occasion the great debility sooner to occur than in inflammation of the uterus; which latter is neither erysipelatous, I suppose, nor contagious. And the success of Dr. Gordon's practice seems to correspond with that of Dr. Rush in the contagious fever or plague at Philadelphia; which appeared to be much assisted by early evacuations. One case I saw some time ago, where violent unceasing pain of the whole abdomen occurred a few hours after delivery, with quick pulse; which ceased after the patient had twice lost about eight ounces of blood, and had taken a moderate cathartic with calomel.

This case induces me to think, that it might be safer and equally efficacious, to take less blood at first, than Dr. Gordon mentions, and to repeat the operation in a few hours, if the continuance of the symptoms should require it. And the same in respect to the cathartic, which might perhaps be given in less quantity, and repeated every two or three hours.

Nor should I wish to give an opiate after the first venesection and cathartic; as I suspect that this might be injurious, except those evacuations had emptied the vessels so much, that the stimulus of the opiate should act only by increasing the absorption of the new vessels or fluids produced on the surfaces of the inflamed membranes. In other inflammations of the bowels, and in acute rheumatism, I have seen the disease much prolonged, and I believe sometimes rendered fatal, by the too early administration of opiates, either along with cathartics, or at their intervals; while a small dose of opium given after sufficient evacuations produces absorption only by its stimulus, and much contributes to the cure of the patient. We may have visible testimony of this effect of opium, when a solution of it is put into an inflamed eye; if it be thus used previous to sufficient evacuation, it increases the inflammation; if it be used after sufficient evacuation, it increases absorption only, and clears the eye in a very small time.

I cannot omit observing, from considering these circumstances, how unwise is the common practice of giving

giving an opiate to every woman immediately after her delivery, which must often have been of dangerous consequence.

END OF THE SECOND PART.

Z O O N O M I Æ A U C T O R I

S. P. D.

A M I C U S.

CURRUS TRIUMPHALIS MEDICINÆ.

Currus it Hygeiæ, Medicus movet arma triumphans,
 Undique victa fugit lurida turma mali.—
 Laurea dum Phœbi viridis tua tempora cingit,
 Nec mortale sonans Fama coronat opus ;
 Post equitat trepidans, repetitque Senectus in aurem,
 Voce canens stridulâ, “ sis memor ipse mori ! ”

THE liberality and candour by which Dr. Darwin is no less distinguished than by his talents and his science, will lead him to look with indulgence on an attempt to convey to the English reader, in the following unpolished lines, something of the spirit and sentiment which characterize the preceding short but elegant and nervous poetic address.

TO THE
 AUTHOR OF ZOOONOMIA
 BY A FRIEND

THE TRIUMPHAL CAR OF MEDICINE.

HEALTH'S car triumphant glides o'er smiling plains,
 While DARWIN'S hand directs the silken reins.
 As slow the wheels on golden axles turn,
 And wide through air irradiate glories burn,
 Youth, Joy and Love around the pageant play,
 And rescued thousands throng the brightening way,
 With brow august, high on the beamy car,
 The CONQUEROR burns in dazzling spoils of war!
 —DISEASE with vanquish'd hosts, in wild affright,
 Retiring hides his Demon-head in night!

Illustrious Sage! while round thy brow divine,
 In fair luxuriance Delphic wreaths entwine,
 And Fame with sounding trump and silver tongue,
 Embalms thy golden page, thy deathless song!
 With trembling limbs *Old Age* moves in the rear,
 Upborne on snow-white steed, and in thy ear,
 Proclaims in accents shrill, with panting breath,
 "Remember thou must yield to conquering DEATH!"

C. C.

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Winking

Z O O N O M I A ;

OR,

The Laws of Organic Life.

PART III.

CONTAINING

THE ARTICLES OF THE MATERIA MEDICA.

WITH AN ACCOUNT OF THE

OPERATION OF MEDICINES.

IN VIVUM CORPUS
AGUNT MEDICAMENTA.



P R E F A C E.

THE MATERIA MEDICA includes all those substances, which may contribute to the restoration of health. These may be conveniently distributed under seven articles according to the diversity of their operations.

1. NUTRIENTIA, or those things which preserve in their natural state the due exertions of all the irritative motions.

2. INCITANTIA, or those things which increase the exertions of all the irritative motions.

3. SECERNENTIA, or those things which increase the irritative motions, which constitute secretion.

4. SORBENTIA, or those things which increase the irritative motions, which constitute absorption.

5. INVERTENTIA, or those things which invert the natural order of the successive irritative motions.

6. REVERTENTIA, or those things which restore the natural order of the inverted irritative motions.

7. TORPENTIA, those things which diminish the exertions of all the irritative motions.

It is necessary to apprize the reader, that in the following account of the virtues of Medicines their usual doses are always supposed to be exhibited; and the patient to be exposed to the degree of exterior heat, which he has been accustomed to, (where the contrary is not mentioned), as any variation of either of these circumstances varies their effects.

ARTICLES

ARTICLES

OF THE

MATERIA MEDICA.

ART. I.

NUTRIENTIA.

I. 1. THOSE THINGS, which preserve in their natural state the due exertions of all the irritative motions, are termed nutrientia; they produce the growth, and restore the waste, of the system. These consist of a variety of mild vegetable and animal substances, water, and air.

2. Where stronger stimuli have been long used, they become necessary for this purpose, as mustard, spice, salt, beer, wine, vinegar, alcohol, opium. Which however, as they are unnatural stimuli, and difficult to manage in respect to quantity, are liable to shorten the span of human life, sooner rendering the system incapable of being stimulated into action by the nutrientia. See Sect. XXXVII. 4. On the same account life is shorter in warmer climates than in more temperate ones.

II. OBSERVATIONS ON THE NUTRIENTIA.

I. 1. The flesh of animals contains more nourishment, and stimulates our absorbent and secreting vessels more powerfully, than the vegetable productions, which we use as food; for the carnivorous animals can fast longer without injury than the graminivorous; and we feel ourselves warmer and stronger after a meal of flesh than of grain. Hence in diseases attended with cold extremities and general debility this kind of diet is preferred; as in rickets, dropsy, scrophula, and in hysteric and hypochondriac cases, and to prevent the returns of agues. Might not flesh in small quantities bruised to a pulp be more advantageously used in fevers attended with debility than vegetable diet?

That flesh, which is of the darkest colour, generally contains more nourishment, and stimulates our vessels more powerfully, than the white kinds. The flesh of the carnivorous and piscivorous animals is so stimulating, that it seldom enters into the food of European nations, except the swine, the Soland goose (*Pelicanus Bassanus*), and formerly the swan. Of these the swine and the swan are fed previously upon vegetable aliment; and the Soland goose is taken in very small quantity, only as a whet to the appetite. Next to these are the birds, that feed upon insects, which are perhaps the most stimulating and the most nutritive of our usual food.

It is said that a greater quantity of volatile alkali can be obtained from this kind of flesh, to which has
been

been ascribed its stimulating quality. But it is more probable, that fresh flesh contains only the elements of volatile alkali.

2. Next to the dark coloured flesh of animals, the various tribes of shell-fish seem to claim their place, and the wholesome kinds of mushrooms, which must be esteemed animal food, both for their alkalescent tendency, their stimulating quality, and the quantity of nourishment, which they afford; as oysters, lobsters, crabfish, shrimps; mushrooms; to which perhaps might be added some of the fish without scales; as the eel, barbolt, tench, smelt, turbot, turtle.

The flesh of many kinds of fish, when it is supposed to have undergone a beginning putrefaction, becomes luminous in the dark. This seems to shew a tendency in the phosphorus to escape, and combine with the oxygen of the atmosphere; and would hence shew, that this kind of flesh is not so perfectly animalized as those before mentioned. This light, as it is frequently seen on rotten wood, and sometimes on veal, which has been kept too long, as I have been told, is commonly supposed to have its cause from putrefaction; but is nevertheless most probably of phosphoric origin, like that seen in the dark on oyster-shells, which have previously been ignited, and afterwards exposed to the sunshine, and on the Bolognian stone. See Botan. Gard. Vol. I. Cant. I. line 1. and 2, the note.

3. The flesh of young animals, as of lamb, veal, and sucking pigs, supplies us with a still less stimulating food. The broth of these is said to become sour, and continues so a considerable time before it changes into putridity; so much does their flesh partake of the chemical properties of the milk, with which these animals are nourished.

4. The white meats, as of turkey, partridge, pheasant, fowl, with their eggs, seem to be the next in mildness; and hence are generally first allowed to convalescents from inflammatory diseases.

5. Next to those should be ranked the white river-fish, which have scales, as pike, perch, gudgeon.

II. 1. Milk unites the animal with the vegetable source of our nourishment, partaking of the properties of both. As it contains sugar, and will therefore ferment and produce a kind of wine or spirit, which is a common liquor in Siberia; or will run into an acid by simple agitation, as in the churning of cream; and lastly, as it contains coagulable lymph, which will undergo the process of putrefaction like other animal substances, as in old cheese.

2. Milk may be separated by rest or by agitation into cream, butter, butter-milk, whey, curd. The cream is easier of digestion to adults, because it contains less of the coagulum or cheesy part, and is also
more

more nutritive. Butter consisting of oil between an animal and vegetable kind contains still more nutriment, and in its recent state is not difficult of digestion if taken in moderate quantity. See Art. I. 2. 3. 2. Butter-milk if it be not bitter is an agreeable and nutritive fluid, if it be bitter it has some putrid parts of the cream in it, which had been kept too long; but is perhaps not less wholesome for being sour to a certain degree: as the inferior people in Scotland choose sour milk in preference to skimmed milk before it is become sour. Whey is the least nutritive and easiest of digestion. And in the spring of the year, when the cows feed on young grass, it contains so much of vegetable properties, as to become a salutary potation, when drank to about a pint every morning to those, who during the winter have taken too little vegetable nourishment, and who are thence liable to bilious concretions.

3. Cheese is of various kinds, according to the greater or less quantity of cream, which it contains, and according to its age. Those cheeses, which are easiest broken to pieces in the mouth, are generally easiest of digestion, and contain most nutriment. Some kinds of cheese, though slow of digestion, are also slow in changing by chemical processes in the stomach, and therefore will frequently agree well with those, who have a weak digestion; as I have seen toasted cheese vomited up a whole day after it was eaten without having undergone any apparent change, or

given any uneasiness to the patient. It is probable a portion of sugar, or of animal fat, or of the gravy of boiled or roasted meat, mixed with cheese at the time of making it, might add to its pleasant and nutritious quality.

4. The reason, why autumnal milk, is so much thicker or coagulable than vernal milk, is not easy to understand, but as new milk is in many respects similar to chyle, it may be considered as food already in part digested by the animal it is taken from, and thence supplies a nutriment of easy digestion. But as it requires to be curdled by the gastric acid, before it can enter the lacteals, as is seen in the stomachs of calves, it seems more suitable to children, whose stomachs abound more with acidity, than to adults; but nevertheless supplies good nourishment to many of the latter, and particularly to those, who use vegetable food, and whose stomachs have not been much accustomed to the unnatural stimulus of spice, salt, and spirit. See Class I. 1. 2. 5.

III. I. The seeds, roots, leaves, and fruits of plants, constitute the greatest part of the food of mankind; the respective quantities of nourishment, which these contain, may perhaps be estimated from the quantity of starch, or of sugar, they can be made to produce: in farinaceous seeds, the mucilage seems gradually to be converted into starch, while they remain in our granaries; and the starch by the germination

nation of the young plant, as in making malt from barley, or by animal digestion, is converted into sugar. Hence old wheat and beans contain more starch than new; and in our stomachs other vegetable and animal materials are converted into sugar; which constitutes in all creatures a part of their chyle.

Hence it is probable, that sugar is the most nutritive part of vegetables; and that they are more nutritive, as they are convertible in greater quantity into sugar by the power of digestion; as appears from sugar being found in the chyle of all animals, and from its existing in great quantity in the urine of patients in the diabætes, of which a curious case is related in Sect. XXIX. 4. where a man labouring under this malady eat and drank an enormous quantity, and sometimes voided sixteen pints of water in a day, with an ounce of sugar in each pint.

2. Oil, when mixed with mucilage or coagulable lymph, as in cream or new milk, is easy of digestion, and constitutes probably the most nutritive part of animal diet; as oil is another part of the chyle of all animals. As these two materials, sugar and butter, contain much nutriment under a small volume, and readily undergo some chemical change so as to become acid or rancid; they are liable to disturb weak stomachs, when taken in large quantity, more than aliment, which contains less nourishment; and is at the same time less liable to chemical changes; because the chyle is produced quicker than the torpid lacteals can absorb

absorb it, and thence undergoes a further chemical process. Sugar and butter therefore are not so easily digested, when taken in large quantity, as those things, which contain less nutriment; hence, where the stomach is weak, they must be used in less quantity. But the custom of some people in restraining children entirely from them, is depriving them of a very wholesome, agreeable, and substantial part of their diet. Honey, manna, sap-juce, are different kinds of less pure sugar.

3. All the esculent vegetables contain a bland oil, or mucilage, or starch, or sugar, or acid; and, as their stimulus is moderate, are properly given alone as food in inflammatory diseases; and mixed with milk constitute the food of thousands. Other vegetables possess various degrees and various kinds of stimulus; and to these we are beholden for the greater part of our *Materia Medica*, which produce nausea, sickness, vomiting, catharsis, intoxication, inflammation, and even death, if unskilfully administered.

The acrid or intoxicating, and other kinds of vegetable juices, such as produce sickness, or evacuate the bowels, or such even as are only disagreeable to the palate, appear to be a part of the defence of those vegetables, which possess them, from the assaults of larger animals or of insects. As mentioned in the *Botanic Garden*, Part II. Cant. I. line 161, note. This appears in a forcible manner from the perusal of some travels, which have been published of those
unfortunate

unfortunate people, who have suffered shipwreck on uncultivated countries, and have with difficulty found food to subsist, in otherwise not inhospitable climates.

4. As these acrid and intoxicating juices generally reside in the mucilage, and not in the starch of many roots, and seeds, according to the observation of M. Parmentier, the wholesome or nutritive parts of some vegetables may be thus separated from the medicinal parts of them. Thus if the root of white briony be rasped into cold water, by means of a bread-grater made of a tinned iron plate, and agitated in it, the acrid juice of the root along with the mucilage will be dissolved, or swim, in the water; while a starch perfectly wholesome and nutritious will subside, and may be used as food in times of scarcity.

M. Parmentier further observes, that potatoes contain too much mucilage in proportion to their starch, which prevents them from being converted into good bread. But that if the starch be collected from ten pounds of raw potatoes by grating them into cold water, and agitating them, as above mentioned; and if the starch thus procured be mixed with other ten pounds of boiled potatoes, and properly subjected to fermentation like wheat flour, that it will make as good bread as the finest wheat.

Good bread may also be made by mixing wheat-flour with boiled potatoes. Eighteen pounds of wheat-flour are said to make twenty-two pounds and a half
of

of bread. Eighteen pounds of wheat-flour mixed with nine pounds of boiled potatoes, are said to make twenty-nine pounds and a half of bread. This difference of weight must arise from the difference of the previous dryness of the two materials. The potatoes might probably make better flour, if they were boiled in steam, in a close vessel, made some degrees hotter than common boiling water.

Other vegetable matters may be deprived of their too great acrimony by boiling in water, as the great variety of the cabbage, the young tops of white briony, water-creffes, asparagus, with innumerable roots, and some fruits. Other plants have their acrid juices or bitter particles diminished by covering them from the light by what is termed blanching them, as the stems and leaves of cellery, endive, sea-kale. The former method either extracts or decomposes the acrid particles, and the latter prevents them from being formed. See Botanic Garden, Vol. I. additional note XXXIV. on the Etiolation of vegetables.

5. The art of cookery, by exposing vegetable and animal substances to heat, has contributed to increase the quantity of the food of mankind by other means besides that of destroying their acrimony. One of these is by converting the acerb juices of some fruits into sugar, as in the baking of unripe pears, and the bruising of unripe apples; in both which situations the life of the vegetable is destroyed, and the conversion of the harsh juice into a sweet one must be performed

performed by a chemical process; and not by a vegetable one only, as the germination of barley in making malt has generally been supposed.

Some circumstances, which seem to injure the life of several fruits, seem to forward the saccharine process of their juices. Thus if some kinds of pears are gathered a week before they would ripen on the tree, and are laid on a heap and covered, their juice becomes sweet many days sooner. The taking off a circular piece of the bark from a branch of a pear-tree causes the fruit of that branch to ripen sooner by a fortnight, as I have more than once observed. The wounds made in apples by insects occasion those apples to ripen sooner; caprification, or the piercing of figs, in the island of Malta, is said to ripen them sooner; and I am well informed, that when bunches of grapes in this country have acquired their expected size, that if the stalk of each bunch be cut half through, that they will sooner ripen.

The germinating barley in the malt-house I believe acquires little sweetness, till the life of the seed is destroyed, and the saccharine process then continued or advanced by the heat in drying it. Thus in animal digestion, the sugar produced in the stomach is absorbed by the lacteals as fast as it is made, otherwise it ferments, and produces flatulency; so in the germination of barley in the malt-house, so long as the new plant lives, the sugar, I suppose, is absorbed as fast as it is made; but that, which we use in making beer, is the sugar produced by a chemical process
after

after the death of the young plant, or which is made more expeditiously, than the plant can absorb it.

It is probably this saccharine process, which obtains in new hay-stacks too hastily, and which by immediately running into fermentation produces so much heat as to set them on fire. The greatest part of the grain, or feeds, or roots, used in the distilleries, as wheat, canary feed, potatoes, are not I believe previously subjected to germination, but are in part by a chemical process converted into sugar, and immediately subjected to vinous fermentation; and it is probable a process may sometime be discovered of producing sugar from starch or meal; and of separating it from them for domestic purposes by alcohol, which dissolves sugar but not mucilage; or by other means.

Another method of increasing the nutriment of mankind by cookery, is by dissolving cartilages and bones, and tendons, and probably some vegetables, in steam or water at a much higher degree of heat than that of boiling. This is to be done in a close vessel, which is called Papin's digester; in which, it is said, that water may be made red-hot, and will then dissolve all animal substances; and might thus add to our quantity of food in times of scarcity. This vessel should be made of iron, and should have an oval opening at top, with an oval lid of iron larger than the aperture; this lid should be slipped in endways, when the vessel is filled, and then turned, and raised by a screw above it into contact with the
under

under edges of the aperture. There should also be a small tube or hole covered with a weighted valve to prevent the danger of bursting the digester.

Where the powers of digestion are weakened, broths made by boiling animal and vegetable substances in water afford a nutriment; though I suppose not so great as the flesh and vegetables would afford, if taken in their solid form, and mixed with saliva in the act of mastication. The aliment thus prepared should be boiled but a short time, nor should be suffered to continue in our common kitchen-utensils afterwards, as they are lined with a mixture of half lead and half tin, and are therefore unwholesome, though the copper is completely covered. And those soups, which have any acid or wine boiled in them, unless they be made in silver, or in china, or in those pot-vessels, which are not glazed by the addition of lead, are truly poisonous; as the acid, as lemon-juice or vinegar, when made hot, erodes or dissolves the lead and tin lining of the copper-vessels, and the leaden glaze of the porcelain ones. Hence, where silver cannot be had, iron vessels are preferable to tinned copper ones; or those made of tinned iron-plates in the common tin-shops, which are said to be covered with pure or block tin.

6. Another circumstance, which facilitates the nourishment of mankind, is the mechanic art of grinding farinaceous feeds into powder between mill-stones; which may be called the artificial teeth of society. It

is probable, that some soft kinds of wood, especially when they have undergone a kind of fermentation, and become of looser texture, might be thus used as food in times of famine.

Nor is it improbable, that hay, which has been kept in stacks, so as to undergo the saccharine process, may be so managed by grinding and by fermentation with yeast like bread, as to serve in part for the sustenance of mankind in times of great scarcity. Dr. Priestley gave to a cow for some time a strong infusion of hay in large quantity for her drink, and found that she produced during this treatment above double the quantity of milk. Hence if bread cannot be made from ground hay, there is great reason to suspect, that a nutritive beverage may be thus prepared either in its saccharine state, or fermented into a kind of beer.

In times of great scarcity there are other vegetables, which though not in common use, would most probably afford wholesome nourishment, either by boiling them, or drying and grinding them, or by both those processes in succession. Of these are perhaps the tops and the bark of all those vegetables, which are armed with thorns or prickles, as gooseberry trees, holly, gorse, and perhaps hawthorn. The inner bark of the elm tree makes a kind of gruel. And the roots of fern, and probably of very many other roots, as of grass and of clover taken up in winter, might yield nourishment either by boiling or baking, and separating the fibres from the pulp by beating them; or by
I getting

getting only the starch from those, which possess an acrid mucilage, as the white briony.

7. However the arts of cookery and of grinding may increase or facilitate the nourishment of mankind, the great source of it is from agriculture. In the savage state, where men live solely by hunting, I was informed by Dr. Franklin, that there was seldom more than one family existed in a circle of five miles diameter; which in a state of pasturage would support some hundred people, and in a state of agriculture many thousands. The art of feeding mankind on so small a grain as wheat, which seems to have been discovered in Egypt by the immortal name of Ceres; shewed greater ingenuity than feeding them with the large roots of potatoes, which seem to have been a discovery of ill-fated Mexico.

This greater production of food by agriculture than by pasturage, shews that a nation nourished by animal food will be less numerous than if nourished by vegetable; and the former will therefore be liable, if they are engaged in war, to be conquered by the latter, as Abel was slain by Cain. This is perhaps the only valid argument against inclosing open arable fields. The great production of human nourishment by agriculture and pasturage evinces the advantage of society over the savage state; as the number of mankind becomes increased a thousand fold by the arts of agriculture and pasturage; and their happiness is probably under good governments improved in as

great a proportion, as they become liberated from the hourly fear of beasts of prey, from the daily fear of famine, and of the occasional incursions of their cannibal neighbours.

But pasturage cannot exist without property both in the soil, and the herds which it nurtures; and for the invention of arts, and production of tools necessary to agriculture, some must think, and others labour; and as the efforts of some will be crowned with greater success than those of others, an inequality of the ranks of society must succeed; but this inequality of mankind in the present state of the world is too great for the purposes of producing the greatest quantity of human nourishment, and the greatest sum of human happiness; there should be no slavery at one end of the chain of society, and no despotism at the other.—By the future improvements of human reason such governments may possibly hereafter be established, as may a hundred-fold increase the numbers of mankind, and a thousand-fold their happiness.

IV. 1. Water must be considered as a part of our nutriment, because so much of it enters the composition of our solids as well as of our fluids; and because vegetables are now believed to draw almost the whole of their nourishment from this source. As in them the water is decomposed, as it is perspired by them in the sunshine, the oxygen gas increases the quantity and the purity of the atmosphere in their vicinity, and the hydrogen seems to be retained, and to form the
nutritive

nutritive juices, and consequent secretions of resin, gum, wax, honey, oil, and other vegetable productions. See Botanic Garden, Part I. Cant. IV. line 25, note. It has however other uses in the system; besides that of a nourishing material, as it dilutes our fluids, and lubricates our solids; and on all these accounts a daily supply of it is required.

2. River-water is in general purer than spring-water; as the neutral salts washed down from the earth decompose each other, except perhaps the marine salt; and the earths, with which spring-water frequently abounds, is precipitated; yet it is not improbable, that the calcareous earth dissolved in the water of many springs may contribute to our nourishment, as the water from springs, which contain earth, is said to conduce to enrich those lands, which are flooded with it, more than river water.

3. Many arguments seem to shew, that calcareous earth contributes to the nourishment of animals and vegetables. First because calcareous earth constitutes a considerable part of them, and must therefore either be received from without, or formed by them, or both, as milk, when taken as food by a lactescent woman, is decomposed in the stomach by the process of digestion, and again in part converted into milk by the pectoral glands. Secondly, because from the analogy of all organic life, whatever has composed a part of a vegetable or animal may again after its che-

mical solution become a part of another vegetable or animal, such is the general transmigration of matter. And thirdly, because the great use of lime in agriculture on almost all kinds of soil and situation cannot be satisfactorily explained from its chemical properties alone. Though these may also in certain soils and situations have considerable effect.

The chemical uses of lime in agriculture may be, 1. from its destroying in a short time the cohesion of dead vegetable fibres, and thus reducing them to earth, which otherwise is effected by a slow process either by the consumption of insects or by a gradual putrefaction. Thus I am informed that a mixture of lime with oak bark, after the tanner has extracted from it whatever is soluble in water, will in two or three months reduce it to a fine black earth, which, if only laid in heaps, would require as many years to effect by its own spontaneous fermentation or putrefaction. This effect of lime must be particularly advantageous to newly inclosed commons when first broken up.

Secondly, lime for many months continues to attract moisture from the air or earth, which it deprives I suppose of carbonic acid; and then suffers it to exhale again, as is seen on the plastered walls of new houses. On this account it must be advantageous when mixed with dry or sandy soils, as it attracts moisture from the air above or the earth beneath, and this moisture is then absorbed by the lymphatics of the roots of vegetables. Thirdly, by mixing lime with clays it is
believed

believed to make them less cohesive, and thus to admit of their being more easily penetrated by vegetable fibres. A mixture of lime with clays destroys their superabundancy of acid, if such exists, and by uniting with it converts it into gypsum or alabaster. And lastly, fresh lime destroys worms, snails, and other insects, with which it happens to come in contact.

Yet do not all these chemical properties seem to account for the great uses of lime in almost all soils and situations, as it contributes so much to the melioration of the crops, as well as to their increase in quantity. Wheat from land well limed is believed by farmers, millers, and bakers, to be, as they suppose, thinner skinned; that is, it turns out more and better flour; which I suppose is owing to its containing more starch and less mucilage. In respect to grass-ground I am informed, that if a spadeful of lime be thrown on a tussock, which horses or cattle have refused to touch for years, they will for many succeeding seasons eat it quite close to the ground.

One property of lime is not perhaps yet well understood, I mean its producing so much heat, when it is mixed with water; which may be owing to the elementary fluid of heat consolidated in the lime. It is the steam occasioned by this heat, when water is sprinkled upon lime, if the water be not in too great quantity or too cold, which breaks the lime into such fine powder as almost to become fluid, which cannot be effected perhaps by any other means, and which I suppose must give great preference to lime in agricul-

ture, and to the solutions of calcareous earth in water, over chalk or powdered limestone, when spread upon the land.

4. It was formerly believed that waters replete with calcareous earth, such as incrust the inside of tea-kettles, or are said to petrify moss, were liable to produce or to increase the stone in the bladder. This mistaken idea has lately been exploded by the improved chemistry, as no calcareous earth, or a very minute quantity, was found in the calculi analysed by Scheele and Bergman. The waters of Matlock and of Carlsbad, both which cover the moss, which they pass through, with a calcareous crust, are so far from increasing the stone of the bladder or kidneys, that those of Carlsbad are celebrated for giving relief to those labouring under these diseases. *Philos. Trans.* Those of Matlock are drank in great quantities without any suspicion of injury; and I well know a person who for above ten years has drank about two pints a day of cold water from a spring, which very much incrusts the vessels, it is boiled in, with calcareous earth, and affords a copious calcareous sediment with a solution of salt of tartar, and who enjoys a state of uninterrupted health.

V. 1. As animal bodies consist much both of oxygen and azote, which make up the composition of atmospheric air, these should be counted amongst nutritious substances. Besides that by the experiments

of Dr. Priestley it appears, that the oxygen gains admittance into the blood through the moist membranes of the lungs; and seems to be of much more immediate consequence to the preservation of our lives than the other kinds of nutriment above specified.

As the basis of fixed air, or carbonic acid gas, is carbone, which also constitutes a great part both of vegetable and animal bodies; this air should likewise be reckoned amongst nutritive substances. Add to this, that when this carbonic acid air is swallowed, as it escapes from beer or cyder, or when water is charged with it as detruded from limestone by vitriolic acid, it affords an agreeable sensation both to the palate and stomach, and is therefore probably nutritive.

The immense quantity of carbone and of oxygen which constitute so great a part of the limestone countries is almost beyond conception, and, as it has been formed by animals, may again become a part of them, as well as the calcareous matter with which they are united. Whence it may be conceived, that the waters, which abound with limestone in solution, may supply nutriment both to animals and to vegetables, as mentioned above.

VI. 1. The manner, in which nutritious particles are substituted in the place of those, which are mechanically abraded, or chemically decomposed, or which vanish by animal absorption, must be owing to animal appetency, as described in Sect. XXXVII. 3. and is probably

bably similar to the process of inflammation, which produces new vessels and new fluids; or to that which constitutes the growth of the body to maturity. Thus the granulations of new flesh to repair the injuries of wounds are visible to the eye; as well as the callous matter, which cements broken bones; the calcareous matter, which repairs injured snail-shells; and the threads, which are formed by silk-worms and spiders; which are all secreted in a softer state, and harden by exsiccation, or by the contact of the air, or by absorption of their more fluid parts.

Whether the materials, which thus supply the waste of the system, can be given any other way than by the stomach, so as to preserve the body for a length of time, is worth our inquiry; as cases sometimes occur, in which food cannot be introduced into the stomach, as in obstructions of the œsophagus, inflammations of the throat, or in hydrophobia; and other cases are not unfrequent in which the power of digestion is nearly or totally destroyed, as in anorexia epileptica, and in many fevers.

In the former of these circumstances liquid nutriment may sometimes be got into the stomach through a flexible catheter; as described in Class III. I. 1. 15. In the latter many kinds of mild aliment, as milk or broth, have frequently been injected as clysters, together with a small quantity of opium, as ten drops of the tincture, three or four times a day; to which also might be added very small quantities of vinous spirit. But these, as far as I have observed, will not
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long sustain a person, who cannot take any sustenance by the stomach.

2. Another mode of applying nutritive fluids might be by extensive fomentations, or by immersing the whole body in a bath of broth, or of warm milk, which might at the same time be coagulated by rennet, or the acid of the calf's stomach; broth or whey might thus probably be introduced, in part at least, into the circulation, as a solution of nitre is said to have been absorbed in a pediluvium; which was afterwards discovered by the manner in which paper dipped frequently in the urine of the patient and dried, burnt and sparkled like touch-paper. Great quantity of water is also known to be absorbed by those, who have bathed in the warm bath after exercise and abstinence from liquids. Cleopatra was said to travel with 4000 milch-asses in her train, and to bathe every morning in their milk, which she probably might use as a cosmetic rather than a nutritive.

3. The transfusion of blood from another animal into the vein of one, who could take no sustenance by the throat, or digest none by the stomach, might long continue to support him; and perhaps other nutriment, as milk or mucilage, might be this way introduced into the system, but we have not yet sufficient experiments on this subject. See Sect. XXXII. 4. and Class I, 2, 3. 25. and Sup. I. 14. 2.

VII. Various kinds of condiments, or sauces, have been taken along with vegetable or animal food, and have been thought by some to strengthen the process of digestion and consequent process of nutrition. Of these wine, or other fermented liquors, vinegar, salt, spices, and mustard, have been in most common use, and I believe to the injury of thousands. As the stomach by their violent stimulus at length loses its natural degree of irritability, and indigestion is the consequence; which is attended with flatulency and emaciation. Where any of these have been taken so long as to induce a habit, they must either be continued, but not increased; or the use of them should be gradually and cautiously diminished or discontinued, as directed in Sect. XII. 7. 8.

III. CATALOGUE OF THE NUTRIENTIA.

- I. 1. Venison, beef, mutton, hare, goose, duck, woodcock, snipe, moor-game.
 2. Oysters, lobsters, crabs, shrimps, mushrooms, eel, tench, barbolt, smelt, turbot, sole, turtle.
 3. Lamb, veal, sucking-pig.
 4. Turkey, partridge, pheasant, fowl, eggs.
 5. Pike, perch, gudgeon, trout, grayling.
- II. Milk, cream, butter, buttermilk, whey, cheese.
- III. Wheat, barley, oats, peas, potatoes, turnips, carrots, cabbage, asparagus, artichoke, spinach, beet, apple, pear, plumb, apricot, nectarine, peach, strawberry, grape, orange, melon, cucumber, dried figs, raisins, sugar, honey. With a great variety of other roots, feeds, leaves, and fruits.
- IV. Water, river-water, spring-water, calcareous earth,
- V. Air, oxygene, azote, carbonic acid gas.
- VI. Nutritive baths and clysters, transfusion of blood,
- VII. Condiments.

ART. II.

INCITANTIA.

I. 1. THOSE THINGS, which increase the exertions of all the irritative motions, are termed incitantia. As alcohol, or the spirituous part of fermented liquors, opium, and many drugs, which are still esteemed poisons, their proper doses not being ascertained. To these should be added the exhilarating passions of the mind, as joy, love: and externally the application of heat, electricity, ether, essential oils, friction, and exercise.

2. These promote both the secretions and absorptions, increase the natural heat, and remove those pains, which originate from the defect of irritative motions, termed nervous pains; and prevent the convulsions consequent to them. When given internally they induce costiveness, and deep coloured urine; and by a greater dose, intoxication, and its consequences.

II. OBSERVATIONS ON THE INCITANTIA.

I. 1. Opium and alcohol increase all the secretions and absorptions. The increase of the secretion of sensorial power appears from the violent exertions of drunken people; the secretion of sweat is more certainly excited by opium or wine than by any other medicine; and the increase of general heat, which these drugs produce, is an evidence of their effect in promoting

promoting all the secretions ; since an increase of secretion is always attended with increase of heat in the part, as in hepatic and other inflammations.

2. But as they at the same time promote absorption ; those fluids, which are secreted into receptacles, as the urine, bile, intestinal and pulmonary mucus, have again their thinner parts absorbed ; and hence, though the quantity of secreted fluid was increased, yet as the absorption was also increased, the excretion from these receptacles is lessened ; at the same time that it is deeper coloured or of thicker consistence, as the urine, alvine feces, and pulmonary mucus. Whereas the perspiration being secreted on the surface of the body is visible in its increased quantity, before it can be reabsorbed ; whence arises that erroneous opinion, that opium increases the cutaneous secretion, and lessens all the others.

3. It must however be noted, that after evacuations opium seems to promote the absorptions more than the secretions ; if you except that of the sensorial power in the brain, which probably suffers no absorption. Hence its efficacy in restraining hæmorrhages, after the vessels are emptied, by promoting venous absorption.

4. In ulcers the matter is thickened by the exhibition of opium from the increased absorption of the thinner parts of it ; but it is probable, that the whole secretion, including the part which is absorbed,

absorbed, is increased; and hence new fibres are secreted along with the matter, and the ulcer fills with new granulations of flesh. But as no ulcer can heal, till it ceases to discharge; that is, till the absorption becomes as great as the excretion; those medicines, which promote absorption only, are more advantageous for the healing an ulcer after it is filled with new flesh; as the Peruvian bark internally; with bandages and solutions of lead externally.

5. There are many pains which originate from a want of due motion in the part, as those occasioned by cold; and all those pains which are attended with cold extremities, and are generally termed nervous. These are relieved by whatever excites the part into its proper actions, and hence by opium and alcohol; which are the most universal stimulants we are acquainted with. In these cases the effect of opium is produced, as soon as the body becomes generally warm; and a degree of intoxication or sleep follows the cessation of the pain.

These nervous pains (as they are called) frequently return at certain periods of time, and are also frequently succeeded by convulsions; in these cases if opium removes the pain, the convulsions do not come on. For this purpose it is best to exhibit it gradually, as a grain every hour, or half hour, till it intoxicates. Here it must be noted, that a much less quantity will prevent the periods of these cold pains, than is necessary to relieve them after their access. As a grain
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and half of opium given an hour before the expected paroxysm will prevent the cold fit of an intermittent fever, but will not soon remove it, when it is already formed. For in the former case the usual or healthy associations or catenations of motion favour the effect of the medicine; in the latter case these associations or catenations are disordered, or interrupted, and new ones are formed, which so far counteract the effect of the medicine:

When opium has been required in large doses to ease or prevent convulsions, some have advised the patient to omit the use of wine, as a greater quantity of opium might then be exhibited; and as opium seems to increase absorption more, and secretion less, than vinous spirit; it may in some cases be useful to exchange one for the other; as in diseases attended with too great evacuation, as diarrhoea, and dysentery, opium may be preferable; on the contrary in tetanus, or locked-jaw, where inflammation of the system might be of service, wine may be preferable to opium; see Class III. 1. 1. 12. I have generally observed, that a mixture of spirit of wine and warm water, given alternately with the doses of opium, has soonest and most certainly produced that degree of intoxication, which was necessary to relieve the patient in the epilepsia dolorifica.

6. There is likewise some relief given by opium to inflammatory pains, or those from excess of motion in the affected part; but with this difference, that
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this relief from the pains, and the sleep, which it occasions, does not occur till some hours after the exhibition of the opium. This requires to be explained; after the stimulus of opium or of alcohol ceases, as after common drunkenness, a consequent torpor comes on; and the whole habit becomes less irritable by the natural stimuli. Hence the head-achs, sickness, and languor, on the next day after intoxication, with cold skin, and general debility. Now in pains from excess of motion, called inflammatory pains, when opium is given, the pain is not relieved, till the debility comes on after the stimulus ceases to act; for then after the greater stimulus of the opium has exhausted much of the sensorial power; the less stimulus, which before caused the pain, does not now excite the part into unnatural action.

In these cases the stimulus of the opium first increases the pain; and it sometimes happens, that so great a torpor follows, as to produce the death or mortification of the affected part; whence the danger of giving opium in inflammatory diseases, especially in inflammation of the bowels; but in general the pain returns with its former violence, when the torpor above mentioned ceases. Hence these pains attended with inflammation are best relieved by copious venesection, other evacuations, and the class of medicines called torpentia.

7. These pains from excess of motion are attended with increased heat of the whole, or of the affected

part, and a strong quick pulse; the pains from defect of motion are attended with cold extremities, and a weak pulse; which is also generally more frequent than natural, but not always so.

8. Opium and alcohol are the only two drugs, we are much acquainted with, which intoxicate; and by this circumstance are easily distinguished from the *fecernentia* and *forbentia*. Camphor, and *cicuta*, and *nicotiana*, are thought to induce a kind of intoxication; and there are many other drugs of this class, whose effects are less known, or their doses not ascertained; as *atropa belladonna*, *hyoscyamus*, *stramonium*, *prunus laurocerasus*, *menispermum*, *cynoglossum*, some fungi, and the water distilled from black cherry-stones; the last of which was once much in use for the convulsions of children, and was said to have good effect; but is now improvidently left out of our pharmacopœias. I have known one leaf of the *laurocerasus*, shred and made into tea, given every morning for a week with no ill consequence to a weak hysteric lady, but rather perhaps with advantage:

9. The pernicious effects of a continued use of much vinous spirit is daily seen and lamented by physicians; not only early debility, like premature age, but a dreadful catalogue of diseases is induced by this kind of intemperance; as dropsy, gout, leprosy, epilepsy, insanity, as described in *Botanic Garden*, Part II. Canto III. line 357. The stronger or less diluted the spirit is taken, the sooner it seems to destroy, as

in dram-drinkers; but still sooner, when kernels of apricots, or bitter almonds, or laurel-leaf, are infused in the spirit, which is termed ratafia; as then two poisons are swallowed at the same time. And vinegar, as it contains much vinous spirit, is probably a noxious part of our diet. And the distilled vinegar, which is commonly sold in the shops, is truly poisonous, as it is generally distilled by means of a pewter or leaden alembic-head or worm-tube, and abounds with lead; which any one may detect by mixing with it a solution of liver of sulphur. Opium, when taken as a luxury, not as a medicine, is as pernicious as alcohol; as Baron de Tott relates in his account of the opium-eaters in Turkey.

10. It must be observed, that a frequent repetition of the use of this class of medicines so habituates the body to their stimulus, that their dose may gradually be increased to an astonishing quantity, such as otherwise would instantly destroy life; as is frequently seen in those, who accustom themselves to the daily use of alcohol and opium; and it would seem, that these unfortunate people become diseased as soon as they omit their usual potations; and that the consequent gout, dropsy, palsy, or pimpled face, occur from the debility occasioned from the want of accustomed stimulus, or to some change in the contractile fibres, which requires the continuance or increase of it. Whence the cautions necessary to be observed are mentioned in Sect. XII. 7. 8.

II. It is probable, that some of the articles in the subsequent catalogue do not induce intoxication, though they have been esteemed to do so; as tobacco, hemlock, nux vomica, stavifagria; and on this account should rather belong to other arrangements, as to the fecernentia, or forbentia, or invertentia.

II: 1. Externally the application of heat, as the warm bath, by its stimulus on the skin excites the excretory ducts of the perspirative glands, and the mouths of the lymphatics, which open on its surface, into greater action; and in consequence many other irritative motions, which are associated with them. To this increased action is added pleasurable sensation, which adds further activity to the system; and thus many kinds of pain receive relief from this additional atmosphere of heat:

The use of a warm bath of about 96 or 98 degrees of heat, for half an hour once a day for three or four months, I have known of great service to weak people, and is perhaps the least noxious of all unnatural stimuli; which however, like all other great excitement, may be carried to excess, as complained of by the ancients. The unmeaning application of the words relaxation and bracing to warm and cold baths has much prevented the use of this grateful stimulus; and the misuse of the term warm-bath, when applied to baths colder than the body, as to those of Buxton and Matlock, and to artificial baths of less than 90 degrees of heat, which ought to be termed cold ones,

has contributed to mislead the unwary in their application.

The stimulus of wine, or spice, or salt, increases the heat of the system by increasing all or some of the secretions; and hence the strength is diminished afterwards by the loss of fluids, as well as by the increased action of the fibres. But the stimulus of the warm-bath supplies heat rather than produces it; and rather fills the system by increased absorption, than empties it by increased secretion; and may hence be employed with advantage in almost all cases of debility with cold extremities, perhaps even in anasarca, and at the approach of death in fevers. In these cases a bath much beneath 98 degrees, as of 80 or 85, might do injury, as being a cold-bath compared with the heat of the body, though such a bath is generally called a warm one.

The activity of the system thus produced by a bath of 98 degrees of heat, or upwards, does not seem to render the patients liable to take cold, when they come out of it; for the system is less inclined to become torpid than before, as the warmth thus acquired by communication, rather than by increased action, continues long without any consequent chillness. Which accords with the observation of Dr. Fordyce, mentioned in Sup. I. 5. 1. who says, that those who are confined some time in an atmosphere of 120 or 130 degrees of heat, do not feel cold or look pale on coming into a temperature of 30 or 40 degrees; which would produce great paleness and sensation of coldness

in those, who had been some time confined in an atmosphere of only 86 or 90 degrees of heat. *Treatise on Simple Fever*, p. 168.

Hence heat, where it can be confined on a torpid part along with moisture, as on a scrophulous tumour, will contribute to produce suppuration or resolution. This is done by applying a warm poultice, which should be frequently repeated; or a plaster of resin, wax, or fat; or by covering the part with oiled silk; both which last prevent the perspirable matter from escaping as well as the heat of the part, as these substances repel moisture, and are bad conductors of heat. Another great use of the stimulus of heat is by applying it to torpid ulcers, which are generally termed scrophulous or scorbutic, and are much easier inclined to heal, when covered with several folds of flannel.

Mr. — had for many months been afflicted with an ulcer in perinæo, which communicated with the urethra, through which a part of his urine was daily evacuated with considerable pain; and was reduced to a great degree of debility. He used a hot-bath of 96 or 98 degrees of heat every day for half an hour during about six months. By this agreeable stimulus repeated thus at uniform times not only the ulcer healed, contrary to the expectation of his friends, but he acquired greater health and strength, than he had for some years previously experienced.

Mrs. — was affected with transient pains, which were called nervous spasms, and with great fear of diseases, which she did not labour under, with cold

extremities, and general debility. She used a hot-bath every other day of 96 degrees of heat for about four months, and recovered a good state of health, with greater strength and courage, than she had possessed for many months before.

Mr. Z. a gentleman about 65 years of age, who had lived rather intemperately in respect to vinous potation, and had for many years had annual visits of the gout, which now became irregular, and he appeared to be losing his strength, and beginning to feel the effects of age. He used a bath, as hot as was agreeable to his sensations, twice a week for about a year and half, and greatly recovered his health and strength with less frequent and less violent returns of regular gout, and is now near 80 years of age.

When Dr. Franklin, the American philosopher, was in England many years ago, I recommended to him the use of a warm-bath twice a week to prevent the too speedy access of old age, which he then thought that he felt the approach of, and I have been informed, that he continued the use of it till near his death, which was at an advanced age.

All these patients were advised not to keep themselves warmer than their usual habits, after they came out of the bath, whether they went into bed or not; as the design was not to promote perspiration, which weakens all constitutions, and seldom is of service to any. Thus a flannel shirt, particularly if it be worn in warm weather, occasions weakness by stimulating the skin by its points into too great action, and producing

ducing heat in consequence; and occasions emaciation by increasing the discharge of perspirable matter; and in both these respects differs from the effect of warm bathing, which communicates heat to the system at the same time that it stimulates it, and causes absorption more than exhalation.

2. The effect of the passage of an electric shock through a paralytic limb in causing it to contract, besides the late experiments of Galvani and Volta on frogs, intitle it to be classed amongst universal stimulants. Electric shocks frequently repeated daily for a week or two remove chronical pains, as the pleurodyne chronica, Class I. 2. 4. 14. and other chronic pains, which are termed rheumatic, probably by promoting the absorption of some extravasated material. Scrophulous tumours are sometimes absorbed, and sometimes brought to suppurate by passing electric shocks through them daily for two or three weeks.

Miss —, a young lady about eight years of age, had a swelling about the size of a pigeon's egg on her neck a little below her ear, which long continued in an indolent state. Thirty or forty small electric shocks were passed through it once or twice a day for two or three weeks, and it then suppurated and healed without difficulty. For this operation the coated jar of the electric machine had on its top an electrometer, which measured the shocks by the approach of a brass knob, which communicated with the external coating to another, which communicated with the internal

one, and their distance was adjusted by a screw. So that the shocks were so small as not to alarm the child, and the accumulated electricity was frequently discharged, as the wheel continued turning. The tumour was inclosed between two other brass knobs, which were fixed on wires, which passed through glass tubes, the tubes were cemented in two grooves on a board, so that at one end they were nearer each other than at the other, and the knobs were pushed out so far as exactly to include the tumour, as described in the annexed plate, which is about half the size of the original apparatus.

Inflammations of the eyes without fever are frequently cured by taking a stream of very small electric sparks from them, or giving the electric sparks to them, once or twice a day for a week or two; that is, the new vessels, which constitute inflammation in these irritable constitutions, are absorbed by the activity of the absorbents induced by the stimulus of the electric aura. For this operation the easiest method is to fix a pointed wire to a stick of sealing wax, or to an insulating handle of glass, one end of this wire communicates with the prime conductor, and the point is approached near the inflamed eye in every direction.

III. Externally the application of ether, and of essential oils, as of cloves or cinnamon, seem to possess a general stimulating effect. As they instantly relieve tooth-ach, and hiccough, when these pains are

not in violent degree; and camphor in large doses is said to produce intoxication; this effect however I have not been witness to, and have reason to doubt.

The manner in which ether and the essential oils operate on the system when applied externally, is a curious question, as pain is so immediately relieved by them, that they must seem to penetrate by the great fluidity or expansive property of a part of them, as of their odoriferous exhalation or vapour, and that they thus stimulate the torpid part, and not by their being taken up by the absorbent vessels, and carried thither by the long course of circulation; nor is it probable, that these pains are relieved by the sympathy of the torpid membrane with the external skin, which is thus stimulated into action; as it does not succeed, unless it is applied over the pained part. Thus there appears to be three different modes by which extraneous bodies may be introduced into the system, besides that of absorption. 1st. By ethereal transference, as heat and electricity; 2d. by chemical attraction, as oxygen; and 3d. by expansive vapour, as ether and essential oils.

IV. The perpetual necessity of the mixture of oxygen gas with the blood in the lungs evinces, that it must act as a stimulus to the sanguiferous system, as the motions of the heart and arteries presently cease, when animals are immersed in airs which possess no oxygen. It may also subsequently answer another important purpose, as it probably affords the material

for the production of the sensorial power; which is supposed to be secreted in the brain or medullary part of the nerves; and that the perpetual demand of this fluid in respiration is occasioned by the sensorial power, which is supposed to be produced from it, being too subtile to be long confined in any part of the system.

Another proof of the stimulant quality of oxygen appears from the increased acrimony, which the matter of a common abscess possesses, after it has been exposed to the air of the atmosphere, but not before; and probably all other contagious matters owe their fever-producing property to having been converted into acids by their union with oxygen.

As oxygen penetrates the fine moist membranes of the air-vessels of the lungs, and unites with the blood by a chemical attraction, as is seen to happen, when blood is drawn into a basin, the lower surface of the crassamentum is of a very dark red so long as it is covered from the air by the upper surface, but becomes florid in a short time on its being exposed to the atmosphere; the manner of its introduction into the system is not probably by animal absorption but by chemical attraction, in which circumstance it differs from the fluids before mentioned both of heat and electricity, and of ether and essential oils.

As oxygen has the property of passing through moist animal membranes, as first discovered by the great Dr. Priestley, it is probable it might be of use in vibices, and petechiæ in fevers, and in other
bruises;

bruises; if the skin over those parts was kept moist by warm water, and covered with oxygen gas by means of an inverted glass, or even by exposing the parts thus moistened to the atmosphere, as the dark coloured extravasated blood might thus become florid, and by its increase of stimulus facilitate its reabsorption.

Two weak patients, to whom I gave oxygen gas in as pure a state as it can easily be procured from Exeter manganese, and in the quantity of about four gallons a day, seemed to feel refreshed, and stronger, and to look better immediately after respiring it, and gained strength in a short time. Two others, one of whom laboured under confirmed hydrothorax, and the other under a permanent and uniform difficulty of respiration, were not refreshed, or in any way served by the use of oxygen in the above quantity of four gallons a day for a fortnight, which I ascribed to the inirritability of the diseased lungs. For other cases the reader is referred to the publications of Dr. Beddoes; *Considerations on the use of factitious Airs*, sold by Johnson, London.

Its effects would probably have been greater in respect to the quantity breathed, if it had been given in a dilute state, mixed with 10 or 20 times its quantity of atmospheric air, as otherwise much of it returns by expiration without being deprived of its quality, as may be seen by the person breathing on the flame of a candle, which it enlarges. See the *Treatise of Dr. Beddoes* above mentioned.

V. Those passions, which are attended with pleasurable sensation, excite the system into increased action in consequence of that sensation, as joy, and love, as is seen by the flush of the skin. Those passions, which are attended with disagreeable sensation, produce torpor in general by the expence of sensorial power occasioned by inactive pain; unless volition be excited in consequence of the painful sensation; and in that case an increased activity of the system occurs; thus paleness and coldness are the consequence of fear, but warmth and redness are the consequence of anger.

VI. Besides the exertions of the system occasioned by increased stimuli, and consequent irritation, and by the passions of the mind above described, the increased actions occasioned by exercise belong to this article. These may be divided into the actions of the body in consequence of volition, which is generally termed labour; or secondly, in consequence of agreeable sensation, which is termed play or sport; thirdly, the exercise occasioned by agitation, as in a carriage or on horseback; fourthly, that of friction, as with a brush or hand, so much used in the baths of Turkey; and lastly, the exercise of swinging.

The first of these modes of exercise is frequently carried to great excess even amongst our own labourers, and more so under the lash of slavery; so that the body becomes emaciated and sinks under either the present hardships, or by a premature old age,

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The second mode of exercise is seen in the play of all young animals, as kittens, and puppies, and children; and is so necessary to their health as well as to their pleasure, that those children, who are too much confined from it, not only become pale-faced and bloated, with tumid bellies, and consequent worms, but are liable to get habits of unnatural actions, as twitching of their limbs, or of some parts of their countenance; together with an ill-humoured or discontented mind.

Agitation in a carriage or on horseback, as it requires some little voluntary exertion to preserve the body perpendicular, but much less voluntary exertion than in walking, seems the best adapted to invalids; who by these means obtain exercise principally by the strength of the horse, and do not therefore too much exhaust their own sensorial power. The use of friction with a brush or hand, for half an hour or longer morning and evening, is still better adapted to those, who are reduced to extreme debility; as none of their own sensorial power is thus expended, and affords somewhat like the warm-bath activity without self-exertion, and is used as a luxury after warm bathing in many parts of Asia.

Another kind of exercise is that of swinging, which requires some exertion to keep the body perpendicular, or pointing towards the center of the swing, but is at the same time attended with a degree of vertigo; and is described in Class II. 1. 6. 7. IV. 2. 1. 10. Sup. I. 3. and 15.

The necessity of much exercise has perhaps been more insisted upon by physicians, than nature seems to demand. Few animals exercise themselves so as to induce visible sweat, unless urged to it by mankind, or by fear, or hunger. And numbers of people in our market towns, of ladies particularly, with small fortunes, live to old age in health, without any kind of exercise of body, or much activity of mind.

In summer weak people cannot continue too long in the air, if it can be done without fatigue; and in winter they should go out several times in a day for a few minutes, using the cold air like a cold-bath, to invigorate and render them more hardy.

III. CATALOGUE OF THE INCITANTIA.

I. *Papaver somniferum*; poppy, opium.

Alcohol, wine, beer, cyder.

Prunus lauro-cerasus; laurel, distilled water from the leaves.

Prunus cerasus; black cherry, distilled water from the kernels.

Nicotiana tabacum; tobacco? the essential oil, decoction of the leaf.

Atropa belladonna; deadly nightshade, the berries.

Datura stramonium; thorn-apple, the fruit boiled in milk.

Hyoscyamus reticulatus; henbane, the seeds and leaves.

Cynoglossum; hounds tongue.

Menispermum.

Menispermum, cocculus ; Indian berry.

Amygdalus amarus ; bitter almond.

Cicuta ; hemlock. Conium maculatum ?

Strychnos nuc vomica ?

Delphinium steyifagria ?

II. Externally, heat, electricity.

III. Ether, essential oils.

IV. Oxygen gas.

V. Passions of love, joy, anger.

VI. Labour, play, agitation, friction.

ART. III.

SECERNENTIA.

I. THOSE THINGS which increase the irritative motions, which constitute secretion, are termed *secernentia*; which are as various as the glands, which they stimulate into action.

1. Diaphoretics, as aromatic vegetables, essential oils, ether, volatile alkali, neutral salts, antimonial preparations, external heat, exercise, friction, cold water for a time with subsequent warmth, blisters, electric fluid.

2. Sialagogues, as mercury internally, and pyrethrum externally.

3. Expectorants, as squill, onions, gum ammoniac, feneka root, mucilage: some of these increase the pulmonary perspiration, and perhaps the pulmonary mucus.

4. Diuretics, as neutral salts, fixed alkali, balsams, resins, asparagus, cantharides.

5. Cathartics of the mild kind, as fenna, jalap, neutral salts, manna. They increase the secretions of bile, pancreatic juice, and intestinal mucus.

6. The mucus of the bladder is increased by cantharides, and perhaps by oil of turpentine.

7. The mucus of the rectum by aloe internally, by clysters and suppositories externally.

8. The mucus of the cellular membrane is increased by blisters and sinapisms.

9. The mucus of the nostrils is increased by er rhines of the milder kind, as marum, common snuff.

10. The secretion of tears is increased by volatile salts, the vapour of onions, by grief, and joy.

11. All those medicines increase the heat of the body, and remove those pains, which originate from a defect of motion in the vessels, which perform secretion; as pepper produces a glow on the skin, and balsam of Peru is said to relieve the flatulent cholic. But these medicines differ from the preceding class, as they neither induce costiveness nor deep coloured urine in their usual dose, nor intoxication in any dose.

12. Yet if any of these are used unnecessarily, it is obvious, like the incitantia, that they must contribute to shorten our lives by sooner rendering peculiar parts of the system disobedient to their natural stimuli. Of those in daily use the great excess of common salt is probably the most pernicious, as it enters all our

cookery, and is probably one cause of scrophula, and of sea-scurvy, when joined with other causes of debility. See Botanic Garden, Part II. Canto IV. line 221. Spices taken to excess by stimulating the stomach, and the vessels of the skin by association, into unnecessary action, contribute to weaken these parts of the system, but are probably less noxious than the general use of so much salt.

II. OBSERVATIONS ON THE SECERNENTIA.

I. 1. Some of the medicines of this class produce absorption in some degree, though their principal effect is exerted on the secerning part of our system. We shall have occasion to observe a similar circumstance in the next class of medicines termed Sorbentia; as of these some exert their effects in a smaller degree on the secerning system. Nor will this surprize any one, who has observed, that all natural objects are presented to us in a state of combination; and that hence the materials, which produce these different effects, are frequently found mingled in the same vegetable. Thus the pure aromatics increase the action of the vessels, which secrete the perspirable matter; and the pure astringents increase the action of the vessels, which absorb the mucus from the lungs, and other cavities of the body; hence it must happen, that nutmeg, which possesses both these qualities, should have the double effect above mentioned.

Other drugs have this double effect, and belong either to the class of Secernentia or Sorbentia, according to the dose in which they are exhibited. Thus a small dose of alum increases absorption, and induces costiveness; and a large one increases the secretions into the intestinal canal, and becomes cathartic. And this accounts for the constipation of the belly left after the purgative quality of rhubarb ceases, for it increases absorption in a smaller dose, and secretion in a greater. Hence when a part of the larger dose is carried out of the habit by stools, the small quantity which remains induces costiveness. Hence rhubarb exhibited in small doses, as 2 or 3 grains twice a day, strengthens the system by increasing the action of the absorbent vessels, and of the intestinal canal.

2. Diaphoretics. The perspiration is a secretion from the blood in its passage through the capillary vessels, as other secretions are produced in the termination of the arteries in the various glands. After this secretion the blood loses its florid colour, which it regains in its passage through the lungs; which evinces that something besides water is secreted on the skins of animals.

No statical experiments can ascertain the quantity of our perspiration; as a continued absorption of the moisture of the atmosphere exists at the same time both by the cutaneous and pulmonary lymphatics.

3. Every gland is capable of being excited into greater exertions by an appropriated stimulus applied

either by its mixture with the blood immediately to the fecerning vessel, or applied externally to its excretory duct. Thus mercury internally promotes an increased salivation, and pyrethrum externally applied to the excretory ducts of the salival glands. Aloes stimulate the rectum internally mixed with the circulating blood; and sea-salt by injection externally. Now as the capillaries, which secrete the perspirable matter, lie near the surface of the body, the application of external heat acts immediately on their excretory ducts, and promotes perspiration; internally those drugs which possess a fragrant essential oil, or spiritus rector, produce this effect, as the aromatic vegetables, of which the number is very great.

4. It must be remembered, that a due quantity of some aqueous vehicle must be given to support this evacuation; otherwise a burning heat without much visible sweat must be the consequence. When the skin acquires a degree of heat much above 108, as appears by Dr. Alexander's experiments, no visible sweat is produced; which is owing to the great heat of the skin evaporating it as hastily, as it is secreted; and, where the sweat is secreted in abundance, its evaporation cannot carry off the exuberant heat, like the vapour of boiling water; because a great part of it is wiped off, or absorbed by the bed-clothes; or the air about the patient is not changed sufficiently often, as it becomes saturated with the perspirable matter. And hence it is probable, that the waste of perspirable matter is as great, or greater, when the
skin

skin is hot and dry; as when it stands in drops on the skin; as appears from the inextinguishable thirst.

Hence Dr. Alexander found, that when the heat of the body was greater than 108, nothing produced sweats but repeated draughts of cold water; and of warm fluids, when the heat was much below that degree. And that cold water which procured sweats instantaneously when the heat was above 108, stopped them as certainly when it was below that heat; and that flannels, wrung out of warm water and wrapped round the legs and thighs, were then most certainly productive of sweats.

5. The diaphoretics are all said to succeed much better, if given early in the morning, about an hour before sun-rise, than at any other time; which is owing to the great excitability of every part of the system after the sensorial power has been accumulated during sleep. In those, who have hectic fever, or the febricula, or nocturnal fever of debility, the morning sweats are owing to the decline of the fever-fit, as explained in Sect. XXXII. 9. In some of these patients the sweat does not occur till they awake; because then the system is still more excitable than during sleep, because the assistance of the voluntary power in respiration facilitates the general circulation. See Class I. 2. 1. 3.

6. It must be observed, that the skin is very dry and hard to the touch, where the absorbents, which

open on its surface, do not act; as in some dropsies, and other diseases attended with great thirst. This dryness, and shrivelled appearance, and roughness, are owing to the mouths of the absorbents being empty of their accustomed fluid, and is distinguishable from the dryness of the skin above mentioned in the hot fits of fever, by its not being attended with heat.

As the heat of the skin in the usual temperature of the air always evinces an increased perspiration, whether visible or not, the heat being produced along with the increase of secretion; it follows, that a defect of perspiration can only exist, when the skin is cold.

7. Volatile alkali is a very powerful diaphoretic, and particularly if exhibited in wine-whey; 20 drops of spirit of hartshorn every half hour in half a pint of wine-whey, if the patient be kept in a moderately warm bed, will in a few hours elicit most profuse sweats.

Neutral salts promote invisible perspiration, when the skin is not warmed much externally, as is evinced from the great thirst, which succeeds a meal of salt provisions, as of red herrings. When these are sufficiently diluted with water, and the skin kept warm, copious sweats without inflaming the habit, are the consequence. Half an ounce of vinegar saturated with volatile alkali, taken every hour or two hours, well answers this purpose; and is preferable perhaps in general to all others, where sweating is advantage-

ous. Boerhaave mentions one cured of a fever by eating red-herrings or anchovies, which, with repeated draughts of warm water or tea, would I suppose produce copious perspiration.

Antimonial preparations have also been of late much used with great advantage in diaphoretics. For the history and use of these preparations I shall refer the reader to the late writers on the *Materia Medica*, only observing that the stomach becomes so soon habituated to its stimulus, that the second dose may be considerably increased, if the first had no operation.

Where it is advisable to procure copious sweats, the emetics, as ipecacuanha, joined with opiates, as in Dover's powder, produce this effect with greater certainty than the above.

8. We must not dismiss this subject without observing, that perspiration is designed to keep the skin flexible, as the tears are intended to clean and lubricate the eye; and that neither of these fluids can be considered as excretions in their natural state, but as secretions. See Class I. 1. 2. 3. And that therefore the principal use of diaphoretic medicines is to warm the skin, and thence in consequence to produce the natural degree of insensible perspiration in languid habits.

9. When the skin of the extremities is cold, which is always a sign of present debility, the digestion becomes frequently impaired by association, and car-

dialgia or heartburn is induced from the vinous or acetous fermentation of the aliment. In this disease diaphoretics, which have been called cordials, by their action on the stomach restore its exertion, and that of the cutaneous capillaries by their association with it, and the skin becomes warm, and the digestion more vigorous.

10. But a blister acts with more permanent and certain effect by stimulating a part of the skin, and thence affecting the whole of it, and of the stomach by association, and thence removes the most obstinate heartburns and vomitings. From this the principal use of blisters is understood, which is to invigorate the exertions of the arterial and lymphatic vessels of the skin, producing an increase of insensible perspiration, and of cutaneous absorption; and to increase the action of the stomach, and the consequent power of digestion; and thence by sympathy to excite all the other irritative motions: hence they relieve pains of the cold kind, which originate from defect of motion; not from their introducing a greater pain, as some have imagined, but by stimulating the torpid vessels into their usual action; and thence increasing the action and consequent warmth of the whole skin, and of all the parts which are associated with it.

II. 1. *Sialagogues.* The preparations of mercury consist of a solution or corrosion of that metal by some acid; and, when the dose is known, it is probable that

that they are all equally efficacious. As their principal use is in the cure of the venereal disease, they will be mentioned in the catalogue amongst the forbentia. Where salivation is intended, it is much forwarded by a warm room and warm clothes; and prevented by exposing the patient to his usual habits of cool air and dress, as the mercury is then more liable to go off by the bowels.

2. Any acrid drug, as pyrethrum, held in the mouth acts as a salagogue externally by stimulating the excretory ducts of the salivary glands; and the filiqua hirsuta applied externally to the parotid gland, and even hard substances in the ear, are said to have the same effect. Mastich chewed in the mouth emulges the salivary glands.

3. The unwise custom of chewing and smoking tobacco for many hours in a day not only injures the salivary glands, producing dryness in the mouth when this drug is not used, but I suspect that it also produces schirrhus of the pancreas. The use of tobacco in this immoderate degree injures the power of digestion, by occasioning the patient to spit out that saliva, which he ought to swallow; and hence produces that flatulency, which the vulgar unfortunately take it to prevent. The mucus, which is brought from the fauces by hawking, should be spit out, as well as that coughed up from the lungs; but that which comes spontaneously into the mouth from the salivary glands, should

should be swallowed mixed with our food or alone for the purposes of digestion. See Class I. 2. 2. 7.

III. 1. Expectorants are supposed to increase the secretion of mucus in the branches of the windpipe, or to increase the perspiration of the lungs secreted at the terminations of the bronchial artery.

2. If any thing promotes expectoration toward the end of peripneumonies, when the inflammation is reduced by bleeding and gentle cathartics, small repeated blisters about the chest, with tepid aqueous and mucilaginous or oily liquids, are more advantageous than the medicines generally enumerated under this head; the blisters by stimulating into action the vessels of the skin produce by association a greater activity of those of the mucous membrane, which lines the branches of the wind-pipe, and air-cells of the lungs; and thus after evacuation they promote the absorption of the mucus and consequent healing of the inflamed membrane, while the diluting liquids prevent this mucus from becoming too viscid for this purpose, or facilitate its exspuition.

Blisters, one at a time, on the sides or back, or on the sternum, are also useful towards the end of peripneumonies, by preventing the evening access of cold fit, and thence preventing the hot fit by their stimulus on the skin; in the same manner as five drops of laudanum by its stimulus on the stomach. For the increased actions of the vessels of the skin or stomach excite a greater

greater quantity of the sensorial power of association, and thus prevent the torpor of the other parts of the system; which, when patients are debilitated, is so liable to return in the evening.

3. Warm bathing is of great service towards the end of peripneumony to promote expectoration, especially in those children who drink too little aqueous fluids, as it gently increases the action of the pulmonary capillaries by their consent with the cutaneous ones, and supplies the system with aqueous fluid, and thus dilutes the secreted mucus.

Some have recommended oil externally around the chest, as well as internally, to promote expectoration; and upon the nose, when its mucous membrane is inflamed, as in common catarrh.

IV. 1. Diuretics. If the skin be kept warm, most of these medicines promote sweat instead of urine; and if their dose is enlarged, most of them become cathartic. Hence the neutral salts are used in general for all these purposes. Those indeed, which are composed of the vegetable acid, are most generally used as sudorifics; those with the nitrous acid as diuretics; and these with the vitriolic acid as cathartics: while those united with the marine acid enter our common nutriment, as a more general stimulus. All these increase the acrimony of the urine, hence it is retained a less time in the bladder; and in consequence less of it is reabsorbed into the system, and the apparent quantity

quantity is greater, as more is evacuated from the bladder; but it is not certain from thence, that a greater quantity is secreted by the kidneys. Hence nitre, and other neutral salts, are erroneously given in the gonorrhœa; as they augment the pain of making water by their stimulus on the excoriated or inflamed urethra. They are also erroneously given in catarrhs or coughs, where the discharge is too thin and saline, as they increase the frequency of coughing.

2. Balsam of Copaiva is thought to promote urine more than the other native balsams; and common resin is said to act as a powerful diuretic in horses. These are also much recommended in gleet, and in fluor albus, perhaps more than they deserve; they give a violet smell to the urine, and hence probably increase the secretion of it.

Calcined egg-shells are said to promote urine, perhaps from the phosphoric acid they contain.

3. Cold air and cold water will increase the quantity of urine by decreasing the absorption from the bladder; and neutral and alkalious salts and cantharides by stimulating the neck of the bladder; to discharge the urine as soon as secreted; and alcohol as gin and rum at the beginning of intoxication, if the body be kept cool, occasion much urine by inverting the urinary lymphatics, and thence pouring a fluid into the bladder, which never passed the kidneys. But it is probable,

probable, that those medicines, which give a scent to the urine, as the balsams and resins, but particularly asparagus and garlic, are the only drugs, which truly increase the secretion of the kidneys. Alcohol however, used as above mentioned, and perhaps great doses of tincture of cantharides, may be considered as drastic diuretics, as they pour a fluid into the bladder by the retrograde action of the lymphatics, which are in great abundance spread about the neck of it. See Sect. XXIX. 3.

V. Mild cathartics. The ancients believed that some purges evacuated the bile, and hence were termed Cholagogues; others the lymph, and were termed Hydragogues; and that in short each cathartic selected a peculiar humour, which it discharged. The moderns have too hastily rejected this system; the subject well deserves further observation.

Calomel given in the dose from ten to twenty grains, so as to induce purging without the assistance of other drugs, appears to me to particularly increase the secretion of bile, and to evacuate it; aloe seems to increase the secretion of the intestinal mucus; and it is probable that the pancreas and spleen may be peculiarly stimulated into action by some other of this tribe of medicines; whilst others of them may simply stimulate the intestinal canal to evacuate its contents, as the bile of animals. It must be remarked, that all these cathartic medicines are supposed to be exhibited in their usual doses, otherwise they become drastic purges,

purges, and are treated of in the Class of Invertentia.

VI. The mucus of the bladder is seen in the urine, when cantharides have been used, either internally or externally, in such doses as to induce the strangury. Spirit of turpentine is said to have the same effect. I have given above a dram of it twice a day floating on a glass of water in chronic lumbago without this effect, and the patient gradually recovered.

VII. Aloe given internally seems to act chiefly on the rectum and sphincter ani, producing tenesmus and piles. Externally in clysters or suppositories, common salt seems to act on that bowel with greater certainty. But where the thread-worm or ascarides exist, 60 or 100 grains of aloes reduced to powder and boiled in a pint of gruel, and used as a clyster twice a week for three months, has frequently destroyed them.

VIII. The external application of cantharides by stimulating the excretory ducts of the capillary glands produces a great secretion of subcutaneous mucus with pain and inflammation; which mucaginous fluid, not being able to permeate the cuticle, raises it up; a similar secretion and elevation of the cuticle is produced by actual fire; and by caustic materials, as by the application of the juice of the root of white briony, or bruised mustard-seed. Experiments are
wanting

wanting to introduce some acrid application into practice instead of cantharides, which might not induce the strangury.

Mustard-seed alone is too acrid, and if it be suffered to lie on the skin many minutes is liable to produce a slough and consequent ulcer, and should therefore be mixed with flour when applied to cold extremities. Volatile alkali properly diluted might stimulate the skin without inducing strangury.

IX. The mild errhines are such as moderately stimulate the membrane of the nostrils, so as to increase the secretion of the nasal mucus; as is seen in those, who are habituated to take snuff. The stronger errhines are mentioned in Art. V. 2. 3.

X. The secretion of tears is increased either by applying acrid substances to the eye; or acrid vapours, which stimulate the excretory duct of the lacrymal gland; or by applying them to the nostrils, and stimulating the excretory duct of the lacrymal sack, as treated of in the Section on Instinct.

Or the secretion of tears is increased by the association of the motions of the excretory duct of the lacrymal sack with ideas of tender pleasure, or of hopeless distress, as explained in Sect. XVI. 8. 2. and 3.

XI. The secretion of sensorial power in the brain, is probably increased by opium or wine, because when
taken

taken in certain quantity an immediate increase of strength and activity succeeds for a time, with consequent debility if the quantity taken be so great as to intoxicate in the least degree. The necessity of perpetual respiration shews, that the oxygen of the atmosphere supplies the source of the spirit of animation; which is constantly expended, and is probably too fine to be long contained in the nerves after its production in the brain. Whence it is probable, that the respiration of oxygen gas mixed with common air may increase the secretion of sensorial power; as indeed would appear from its exhilarating effect on most patients.

III. CATALOGUE OF THE SECERNENTIA.

I. Diaphoretics.

1. Amomum zinziber, ginger. Caryophyllus aromaticus, cloves. Piper indicum, pepper. Capsicum. Cardamomum. Pimento, myrtus pimenta. Canella alba. Serpentaria virginiana, aristolochia serpentaria, guaiacum. Sassafras, laurus sassafras. Opium. Wine.
2. Essential oils of cinnamon, laurus cinnamomum. Nutmeg, myristica moschata. Cloves, caryophyllus aromaticus. Mint, mentha. Camphor, laurus camphora. Ether.
3. Volatile salts, as of ammoniac and of hartshorn. Sal cornu cervi.

4. Neutral salts, as those with vegetable acid ;
or with marine acid, as common salt. Halex.
Red-herring, anchovy.
5. Preparations of antimony, as emetic tartar,
antimonium tartarizatum, wine of antimony.
James's powder.
6. External applications. Blisters. Warm bath.
Warm air. Exercise. Friction.
7. Cold water with subsequent warmth.

II. Sialagogues. Preparations of mercury, hydrargyrum. Pyrethrum, anthemis pyrethrum, tobacco, cloves, pepper, cowhage, fizolobium filiqua hirsuta. Mastich, pistacia lentiscus.

III. Expectorants.

1. Squill, scilla maritima, garlic, leek, onion, allium, asafœtida, ferula asafœtida, gum ammoniac, benzoin, tar, pix liquida, balsam of Tolu.
2. Root of feneka, polygala feneka, of elicampagne, inula helenium.
3. Marsh-mallow, althæa, coltsfoot, tussilago farfara, gum arabic, mimosa nilotica, gum tragacanth, astragalus tragacantha. Decoction of barley, hordeum distichon. Expressed oils. Spermaceti, soap. Extract of liquorice, glycyrrhiza glabra. Sugar. Honey.

4. Externally blisters. Oil. Warm bath.

IV. Mild diuretics.

1. Nitre, kali acetatum, other neutral salts.
2. Fixed alkali, soap, calcined egg-shells.
3. Turpentine. Balsam of Copaiva. Resin. Olibanum.
4. Asparagus, garlic, wild daucus. Parsley, apium. Fennel fœniculum, pareira brava, Cissampelos?
5. Externally cold air, cold water.
6. Alcohol. Tincture of cantharides. Opium.

V. Mild cathartics.

1. Sweet subacid fruits. Prunes, prunus domestica. Cassia fistula. Tamarinds, crystals of tartar, unrefined sugar. Manna. Honey.
2. Whey of milk, bile of animals.
3. Neutral salts as Glauber's salt, vitriolated tartar, sea-water, magnesia alba, soap.
4. Gum guaiacum. Balsam of Peru. Oleum ricini, castor-oil, oil of almonds, oil of olives, sulphur.
5. Senna, cassia fenna, jalap, aloe, rhubarb, rheum palmatum.
6. Calomel. Emetic tartar, antimonium tartarizatum.

VI. Secretion of mucus of the bladder is increased by cantharides, by spirit of turpentine?

VII. Secre-

- VII. Secretion of mucus of the rectum is increased by aloe internally, by various clifters and suppositories externally.
- VIII. Secretion of subcutaneous mucus is increased by blisters of cantharides, by application of a thin slice of the fresh root of white briony, by sinapisms, by root of horse-radish, cochlearia armoracia. Volatile alkali.
- IX. Mild errhines. Marjoram. Origanum. Marum, tobacco.
- X. Secretion of tears is increased by vapour of sliced onion, of volatile alkali. By pity, or ideas of hopeless distress.
- XI. Secretion of sensorial power in the brain is probably increased by opium, by wine, and perhaps by oxygen gas added to the common air in respiration.

ART. IV.

SORBENTIA.

I. THOSE THINGS which increase the irritative motions, which constitute absorption, are termed sorbentia; and are as various as the absorbent vessels, which they stimulate into action.

1. Cutaneous absorption is increased by austere acids, as of vitriol; hence they are believed to check colliquative sweats, and to check the eruption of small-pox, and contribute to the cure of the itch, and tinea; hence they thicken the saliva in the mouth, as lemon-juice, crab-juice, flocs.

2. Absorption from the mucous membrane is increased by opium, and Peruvian bark, internally; and by blue vitriol externally. Hence the expectoration in coughs, and the mucous discharge from the urethra, are thickened and lessened.

3. Absorption from the cellular membrane is promoted by bitter vegetables, and by emetics, and cathartics. Hence matter is thickened and lessened in ulcers by opium and Peruvian bark; and serum is absorbed in anasarca by the operation of emetics and cathartics.

4. Venous absorption is increased by acrid vegetables; as water-cress, cellery, horse-radish, mustard. Hence their use in sea-scurvy, the vibices of which
are

are owing to a defect of venous absorption; and by external stimulants, as vinegar, and by electricity, and perhaps by oxygen.

5. Intestinal absorption is increased by astringent vegetables, as rhubarb, galls; and by earthy salts, as alum; and by argillaceous and calcareous earth.

6. Hepatic absorption is increased by metallic salts, hence calomel and sal martis are so efficacious in jaundice, worms, chlorosis, dropsy.

7. Venereal virus in ulcers is absorbed by the stimulus of mercury; hence they heal by the use of this medicine.

8. Venesection, hunger, thirst, and violent evacuations, increase all absorptions; hence sweating produces costiveness.

9. Externally bitter astringent vegetables, earthy and metallic salts, and bandages, promote the absorption of the parts on which they are applied.

10. All these in their usual doses do not increase the natural heat; but they induce costiveness, and deep coloured urine with earthy sediment.

In greater doses they invert the motions of the stomach and lacteals; and hence vomit or purge, as carduus benedictus, rhubarb. They promote perspiration, if the skin be kept warm; as camomile tea, and testaceous powders, have been used as sudorifics.

The preparations of antimony vomit, purge, or sweat, either according to the quantity exhibited, or as a part of what is given is evacuated. Thus a quarter of a grain of emetic tartar (if well prepared) will promote a diaphoresis, if the skin be kept warm; half a grain will procure a stool or two first, and sweating afterwards; and a grain will generally vomit, and then purge, and lastly sweat the patient. In less quantity it is probable, that this medicine acts like other metallic salts, as steel, zinc, or copper in small doses; that is, that it strengthens the system by its stimulus. As camomile or rhubarb in different doses vomit, or purge, or act as stimulants so as to strengthen the system.

II. OBSERVATIONS ON THE SORBENTIA.

I. 1. As there is great difference in the apparent structure of the various glands, and of the fluids which they select from the blood, these glands must possess different kinds of irritability, and are therefore stimulated into stronger or unnatural actions by different articles of the materia medica, as shewn in the fecernentia. Now as the absorbent vessels are likewise glands, and drink up or select different fluids, as chyle, water, mucus, with a part of every different secretion, as a part of the bile, a part of the saliva, a part of the urine, &c. it appears, that these absorbent vessels must likewise possess different kinds of irritability, and in consequence must require different articles

articles of the materia medica to excite them into unusual action. This part of the subject has been so little attended to, that the candid reader will find in this article a great deal to excuse.

It was observed, that some of the fecernentia did in a less degree increase absorption, from the combination of different properties in the same vegetable body; for the same reason some of the class of sorbentia produce secretion in a less degree, as those bitters which have also an aroma in their composition; these are known from their increasing the heat of the system above its usual degree.

It must also be noted, that the actions of every part of the absorbent system are so associated with each other, that the drugs which stimulate one branch increase the action of the whole; and the torpor or quiescence of one branch weakens the exertions of the whole; or when one branch is excited into stronger action, some other branch has its actions weakened or inverted. Yet though peculiar branches of the absorbent system are stimulated into action by peculiar substances, there are other substances which seem to stimulate the whole system, and that without immediately increasing any of the secretions; as those bitters which possess no aromatic scent, at the head of which stands the famed Peruvian bark, or cinchona.

2. Cutaneous absorption. I have heard of some experiments, in which the body was kept cold, and was thought to absorb more moisture from the atmosphere than at any other time. This however

cannot be determined by statical experiments; as the capillary vessels, which secrete the perspirable matter, must at the same time have been benumbed by the cold; and from their inaction there could not have been the usual waste of the weight of the body; and as all other muscular exertions are best performed, when the body possesses its usual degree of warmth, it is conclusive, that the absorbent system should likewise do its office best, when it is not benumbed by external cold.

The austere acids, as of vitriol, lemon-juice, juice of crabs and sloes, strengthen digestion, and prevent that propensity to sweat so usual to weak convalescents, and diminish the colliquative sweats in hectic fevers; all which are owing to their increasing the action of the external and internal cutaneous absorption. Hence vitriolic acid is given in the small-pox to prevent the too hasty or too copious eruption, which it effects, by increasing the cutaneous absorption. Vinegar, from the quantity of alcohol which it contains, exerts a contrary effect to that here described, and belongs to the incitantia; as an ounce of it promotes sweat, and a flushing of the skin; at the same time externally it acts as a venous absorbent, as the lips become pale by moistening them with it. And it is said, when taken internally in great and continued quantity, to induce paleness of the skin, and softness of the bones.

The sweet vegetable acids, as of several ripe fruits, are among the torpentia; as they are less stimulating than the general food of this climate, and are hence used in inflammatory diseases.

Where

Where the quantity of fluids in the system is much lessened, as in hectic fever, which has been of some continuance, or in spurious peripneumony, a grain of opium given at night will sometimes prevent the appearance of sweats; which is owing to the stimulus of opium increasing the actions of the cutaneous absorbents, more than those of the secreting vessels of the skin. Whence the secretion of perspirable matter is not decreased, but its appearance on the skin is prevented by its more facile absorption.

3. There is one kind of itch, which seldom appears between the fingers, is the least infectious, and most difficult to eradicate, and which has its cure much facilitated by the internal use of acid of virriol. This disease consists of small ulcers in the skin, which are healed by whatever increases the cutaneous absorption. The external application of sulphur, mercury, and acrid vegetables, acts on the same principle; for the animalcula, which are seen in these pustules, are the effect, not the cause, of them; as all other stagnating animal fluids, as the semen itself, abounds with similar microscopic animals.

4. Young children have sometimes an eruption upon the head called Tinea, which discharges an acrimonious ichor inflaming the parts on which it falls. This eruption I have seen submit to the internal use of vitriolic acid, when only wheat-flour

was

was applied externally. This kind of eruption is likewise frequently cured by testaceous powders; two materials so widely different in their chemical properties, but agreeing in their power of promoting cutaneous absorption.

II. Absorption from the mucous membrane is increased by applying to its surface the austere acids, as of vitriol, lemon-juice, crab-juice, flocs. When these are taken into the mouth, they immediately thicken, and at the same time lessen the quantity of the saliva; which last circumstance cannot be owing to their coagulating the saliva, but to their increasing the absorption of the thinner parts of it. So alum applied to the tip of the tongue does not stop in its action there, but independent of its diffusion it induces cohesion and corrugation over the whole mouth. (Cullen's *Mat. Med. Art. Astringentia.*) Which is owing to the association of the motions of the parts or branches of the absorbent system with each other.

Absorption from the mucous membrane is increased by opium taken internally in small doses more than by any other medicine, as is seen in its thickening the expectoration in coughs, and the discharge from the nostrils in catarrh, and perhaps the discharge from the urethra in gonorrhœa. The bark seems next in power for all these purposes.

Externally slight solutions of blue vitriol, as two or three grains to an ounce of water, applied to ulcers of the mouth or to chancres on the glans penis,

penis, more powerfully induces them to heal than any other material.

Where the lungs or urethra are inflamed to a considerable degree, and the absorption is so great, that the mucus is already too thick, and adheres to the membrane from its viscosity, opiates and bitter vegetable and austere acids are improper; and mucilaginous diluents should be used in their stead with venesection and torpentina.

III. 1. Absorption from the cellular membrane, and from all the other cavities of the body, is too slowly performed in some constitutions; hence the bloated pale complexion; and when this occurs in its greatest degree, it becomes an universal dropsy. These habits are liable to intermittent fevers, hysteric paroxysms, cold extremities, indigestion, and all the symptoms of debility.

The absorbent system is more subject to torpor or quiescence than the secreting system, both from the coldness of the fluids which are applied to it, as the moisture of the atmosphere, and from the coldness of the fluids which we drink; and also from its being stimulated only by intervals, as when we take our food; whereas the secreting system is perpetually excited into action by the warm circulating blood; as explained in Sect. XXXII.

2. The Peruvian bark, camomile flowers, and other bitter drugs, by stimulating this cellular branch
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of the absorbent system prevents it from becoming quiescent; hence the cold paroxysms of those agues, which arise from the torpor of the cellular lymphatics, are prevented, and the hot fits in consequence. The patient thence preserves his natural heat, regains his healthy colour, and his accustomed strength.

Where the cold paroxysm of an ague originates in the absorbents of the liver, spleen, or other internal viscus, the addition of steel to vegetable bitters, and especially after the use of one dose of calomel, much advances the cure.

And where it originates in any part of the fecerning system, as is probably the case in some kinds of agues, the addition of opium in the dose of a grain and half, given about an hour before the access of the paroxysm, or mixed with chalybeate and bitter medicines, ensures the cure. Or the same may be effected by wine given instead of opium before the paroxysm, so as nearly to intoxicate.

These three kinds of agues are thus distinguished; the first is not attended with any tumid or indurated viscus, which the people call an ague cake, and which is evident to the touch. The second is accompanied with a tumid viscus; and the last has generally, I believe, the quartan type, and is attended with some degree of arterial debility.

3. This class of absorbent medicines are said to decrease irritability. After any part of our system has been torpid or quiescent, by whatever cause that

was produced, it becomes afterwards capable of being excited into greater motion by small stimuli; hence the hot fit of fever succeeds the cold one. As these medicines prevent torpor or quiescence of parts of the system, as cold hands or feet, which perpetually happen to weak constitutions, the subsequent increase of irritability of these parts is likewise prevented.

4. These absorbent medicines, including both the bitters, and metallic salts, and opiates, are of great use in the dropsy by their promoting universal absorption; but here evacuations are likewise to be produced, as will be treated of in the Invertentia.

5. The matter in ulcers is thickened, and thence rendered less corrosive, the saline part of it being reabsorbed by the use of bitter medicines; hence the bark is used with advantage in the cure of ulcers.

6. Bitter medicines strengthen digestion by promoting the absorption of chyle; hence the introduction of hop into the potation used at our meals, which as a medicine may be taken advantageously, but, like other unnecessary stimuli, must be injurious as an article of our daily diet.

The hop may perhaps in some degree contribute to the production of gravel in the kidneys, as our intemperate wine-drinkers are more subject to the gout, and ale-drinkers to the gravel; in the formation of both
which

which diseases, there can be no doubt, but that the alcohol is the principal, if not the only agent.

7. Vomits greatly increase the absorption from the cellular membrane, as squill, and foxglove. The squill should be given in the dose of a grain of the dried root every hour, till it operates upwards and downwards. Four ounces of the fresh leaves of the foxglove should be boiled from two pounds of water to one, and half an ounce of the decoction taken every two hours for four or more doses. This medicine by stimulating into inverted action the absorbents of the stomach, increases the direct action of the cellular lymphatics.

Another more convenient way of ascertaining the dose of foxglove is by making a saturated tincture of it in proof spirit; which has the twofold advantage of being invariable in its original strength, and of keeping a long time as a shop-medicine without losing any of its virtue. Put two ounces of the leaves of purple foxglove, *digitalis purpurea*, nicely dried, and coarsely powdered, into a mixture of four ounces of rectified spirit of wine and four ounces of water; let the mixture stand by the fire-side twenty-four hours frequently shaking the bottle, and thus making a saturated tincture of *digitalis*; which must be poured from the sediment or passed through filtering paper.

As the size of a drop is greater or less according to the size of the rim of the phial from which it is dropped, a part of this saturated tincture is then directed

directed to be put into a two-ounce phial, for the purpose of ascertaining the size of the drop. Thirty drops of this tincture is directed to be put into an ounce of mint-water for a draught to be taken twice or thrice a day, till it reduces the anasarca of the limbs, or removes the difficulty of breathing in hydrothorax, or till it induces sickness. And if these do not occur in two or three days, the dose must be gradually increased to forty or sixty drops, or further.

From the great stimulus of this medicine the stomach is rendered torpid with consequent sickness, which continues many hours and even days, owing to the great exhaustion of its sensorial power of irritation; and the action of the heart and arteries becomes feeble from the deficient excitement of the sensorial power of association; and lastly, the absorbents of the cellular membrane act more violently in consequence of the accumulation of the sensorial power of association in the torpid heart and arteries, as explained in Suppl. I. 12.

A circumstance curiously similar to this occurs to some people on smoking tobacco for a short time, who have not been accustomed to it. A degree of sickness is presently induced, and the pulsations of the heart and arteries become feeble for a short time, as in the approach to fainting, owing to the direct sympathy between these and the stomach, that is from defect of the excitement of the power of association. Then there succeeds a tingling, and heat, and sometimes sweat, owing to the increased action

of the capillaries, or perspirative and mucous glands; which is occasioned by the accumulation of the sensorial power of association by the weaker action of the heart and arteries, which now increases the action of the capillaries.

8. Another method of increasing absorption from the cellular membrane is by warm air, or by warm steam. If the swelled legs of a dropical patient are inclosed in a box, the air of which is made warm by a lamp or two, copious sweats are soon produced by the increased action of the capillary glands, which are seen to stand on the skin, as it cannot readily exhale in so small a quantity of air, which is only changed so fast as may be necessary to permit the lamps to burn. At the same time the lymphatics of the cellular membrane are stimulated by the heat into greater action, as appears by the speedy reduction of the tumid legs.

It would be well worth trying an experiment upon a person labouring under a general anasarca by putting him into a room filled with air heated to 120 or 130 degrees, which would probably excite a great general diaphoresis, and a general cellular absorption both from the lungs and every other part. And that air of so great heat may be borne for many minutes without great inconvenience was shewn by the experiments made in heated rooms by Dr. Fordyce and others. *Philos. Transf.*

Another

Another experiment of using warmth in anasarca, or in other diseases, might be by immersing the patient in warm air, or in warm steam, received into an oil-skin bag, or bathing-tub of tin, so managed, that the current of warm air or steam should pass round and cover the whole of the body except the head, which might not be exposed to it; and thus the absorbents of the lungs might be induced to act more powerfully by sympathy with the skin, and not by the stimulus of heat. See Uses of Warm Bath, Class IV. 2. 2. 1.

IV. 1. Venous absorption. Cellery, water-creffes, cabbages, and many other vegetables of the Class Tetradyamia, do not increase the heat of the body (except those whose acrimony approaches to corrosion), and hence they seem alone, or principally, to act on the venous system; the extremities of which we have shewn are absorbents of the red blood, after it has passed the capillaries and glands.

2. In the sea-scurvy and petechial fever the veins do not perfectly perform this office of absorption; and hence the vibices are occasioned by blood stagnating at their extremities, or extravasated into the cellular membrane. And this class of vegetables, stimulating the veins to perform their natural absorption, without increasing the energy of the arterial action, prevents future petechiæ, and may assist the absorption of the blood already stagnated, as

soon as its chemical change renders it proper for that operation.

3. The fluids, which are extravasated, and received into the cells of the cellular membrane, seem to continue there for many days, so as to undergo some chemical change, and are then taken up again by the mouths of the cellular absorbents. But the new vessels produced in inflamed parts, as they communicate with the veins, are probably absorbed again by the veins along with the blood which they contain in their cavities. Hence the blood, which is extravasated in bruises or vibices, is gradually many days in disappearing; but after due evacuations the inflamed vessels on the white of the eye, if any stimulant lotion is applied, totally disappear in a few hours.

Amongst absorbents affecting the veins we should therefore add the external application of stimulant materials; as of vinegar, which makes the lips pale on touching them. Friction, and electricity.

4. Hæmorrhages are of two kinds, either arterial, which are attended with inflammation; or venous, from a deficiency in the absorbent power of this set of vessels. In the former case the torpentia are efficacious; in the latter steel, opium, alum, and all the tribe of sorbentia, are used with success.

5. Sydenham recommends vegetables of the class Tetradymania in rheumatic pains left after the cure
of

of intermittents. These pains are perhaps similar to those of the sea-scurvy, and seem to arise from want of absorption in the affected part, and hence are relieved by the same medicines.

V. 1. Intestinal absorption. Some astringent vegetables, as rhubarb, may be given in such doses as to prove cathartic; and, after a part of it is evacuated from the body, the remaining part augments the absorption of the intestines; and acts, as if a similar dose had been exhibited after the operation of any other purgative. Hence 4 grains of rhubarb strengthen the bowels, 30 grains first empty them.

2. The earthy salts, as alum, increase the intestinal absorption, and hence induce constipation in their usual dose; alum is said sometimes to cure intermittents, perhaps when their seat is in the intestines, when other remedies have failed. It is useful in the diabætes by exciting the absorbents of the bladder into their natural action; and combined with resin is esteemed in the fluor albus, and in gleet. Lime-stone or chalk, and probably gypsum, possess effects in some degree similar, and increase the absorption of the intestines; and thus in certain doses restrain some diarrhoeas, but in greater doses alum I suppose will act as a cathartic. Five or ten grains produce constipation, 20 or 30 grains are either emetic or cathartic.

3. Earth of alum, tobacco-pipe clay, marl, Armenian bole, lime, crab's eyes or claws, and calcined
E e 2 hartshorn,

hartshorn, or bone ashes, restrain fluxes; either mechanically by supplying something like mucilage, or oil, or rollers to abate the friction of the aliment over inflamed membranes; or by increasing their absorption. The two last consist of calcareous earth united to phosphoric acid, and the Armenian bole and marl may contain iron: By the consent between the intestines and the skin 20 grains of Armenian bole given at going into bed to hectic patients will frequently check their tendency to sweat as well as to purge, and the more certainly if joined with one grain of opium.

VI. 1. Absorption from the liver, stomach, and other viscera. When inflammations of the liver are subdued to a certain degree by venesection, with calomel and other gentle purges, so that the arterial energy becomes weakened, four or eight grains of iron-filings, or of salt of steel, with the Peruvian bark, have wonderful effect in curing the cough, and restoring the liver to its usual size and sanity; which it seems to effect by increasing the absorption of this viscus. The same I suppose happens in respect to the tumours of other viscera, as of the spleen, or pancreas, some of which are frequently enlarged in agues.

2. Hæmorrhages from the nose, rectum, kidneys, uterus, and other parts, are frequently attendant on diseased livers; the blood being impeded in the vena portarum from the decreased power of absorption, and in consequence of the increased size of this viscus.

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These hæmorrhages after venesection, and a mercurial cathartic, are most certainly restrained by steel alone, or joined with an opiate; which increase the absorption, and diminish the size of the liver.

Chalybeates may also restrain these hæmorrhages by their promoting venous absorption, though they exert their principal effect upon the liver. Hence also opiates, and bitters, and vitriolic acid, are advantageously used along with them. It must be added that some hæmorrhages recur by periods like the paroxysms of intermittent fevers, and are thence cured by the same treatment.

3. The jaundice is frequently caused by the insipidity of the bile, which does not stimulate the gall-bladder and bile-duets into their due action; hence it stagnates in the gall-bladder, and produces a kind of crystallization, which is too large to pass into the intestines, blocks up the bile-duct, and occasions a long and painful disease. A paralysis of the bile duct produces a similar jaundice, but without pain.

4. Worms in sheep called flukes are owing to the dilute state of the bile; hence they originate in the intestines, and thence migrate into the biliary ducts, and corroding the liver produce ulcers, cough, and hectic fever, called the rot. In human bodies it is probable the inert state of the bile is one cause of the production of worms; which insipid state of the bile is owing to deficient absorption of the thinner

parts of it; hence the pale and bloated complexion, and swelled upper lip, of wormy children, is owing to the concomitant deficiency of absorption from the cellular membrane. Salt of steel, or the rust of it, or filings of it, with bitters, increase the acrimony of the bile by promoting the absorption of its aqueous part; and hence destroy worms; as well as by their immediate action on the intestines, or on the worms themselves. The cure is facilitated by premising a purge with calomel. See Class I. 2. 3. 9.

5. The chlorosis is another disease owing to the deficient action of the absorbents of the liver, and perhaps in some degree also to that of the secretory vessels, or glands, which compose that viscus. Of this the want of the catamenia, which is generally supposed to be a cause, is only a symptom or consequence. In this complaint the bile is deficient perhaps in quantity, but certainly in acrimony, the thinner part not being absorbed from it. Now as the bile is probably of great consequence in the process of making the blood; it is on this account that the blood is so destitute of red globules; which is evinced by the great paleness of these patients. As this serous blood must exert less stimulus on the heart, and arteries, the pulse in consequence becomes quick as well as weak, as explained in Sect. XII. 1. 4.

The quickness of the pulse is frequently so great and permanent, that when attended by an accidental cough, the disease may be mistaken for hectic fever;

but is cured by chalybeates, and bitters exhibited twice a day; with half a grain of opium, and a grain of aloe every night; and the expected catamenia appears in consequence of a restoration of the due quantity of red blood. This and the two former articles approach to the disease termed paralyfis of the liver. Sect. XXX. 4.

6. It seems paradoxical, that the same treatment with chalybeates, bitters, and opiates, which produces menstruation in chlorotic patients, should repress the too great or permanent menstruation, which occurs in weak constitutions at the time of life when it should cease. This complaint is an hæmorrhage owing to the debility of the absorbent power of the veins, and belongs to the paragraph on venous absorption above described, and is thence curable by chalybeates, alum, bitters, and particularly by the exhibition of a grain of opium every night with five grains of rhubarb.

7. Metallic salts supply us with very powerful remedies for promoting absorption in dropfical cases; which frequently are caused by enlargement of the liver. First, as they may be given in such quantities as to prove strongly cathartic, of which more will be said in the article on invertentia; and then, when their purgative quality ceases, like the effect of rhubarb, their absorbent quality continues to act. The salts of mercury, silver, copper, iron, zinc, antimony, have all been used in the dropfy; either singly for

the former purpose, or united with bitters for the latter, and occasionally with moderate but repeated opiates.

8. From a quarter of a grain to half a grain of blue vitriol given every four or six hours, is said to be very efficacious in obstinate intermittents; which also frequently arise from an enlarged viscus, as the liver or spleen, and are thence owing to the deficient absorption of the lymphatics of that viscus. A quarter of a grain of white arsenic, as I was informed by a surgeon of the army, cures a quartan ague with great certainty, if it be given an hour before the expected fit. This dose he said was for a robust man, perhaps one eighth of a grain might be given and repeated with greater safety and equal efficacy.

Dr. Fowler has given many successful cases in his treatise on this subject. He prepares it by boiling sixty-four grains of white arsenic in a Florence flask along with as much pure vegetable fixed alkali in a pint of distilled water, till it is dissolved, and then adding to it as much distilled water as will make the whole exactly sixteen ounces. Hence there are four grains of arsenic in every ounce of the solution. This should be put into a phial of such a size of the edge of its aperture, that sixty drops may weigh one dram, which will contain half a grain of arsenic. To children from two years old to four he gives from two to five drops three or four times a day. From five years old to seven, he directs from seven to eight drops. From eight years old to twelve, he directs from seven to ten drops,

drops. From thirteen years old to eighteen he directs from ten to twelve drops. From eighteen upwards, twelve drops. In so powerful a medicine it is always prudent to begin with smaller doses, and gradually to increase them.

A saturated solution of arsenic in water is preferable I think to the above operose preparation of it; as no error can happen in weighing the ingredients, and it more certainly therefore possesses an uniform strength. Put much more white arsenic reduced to powder into a given quantity of distilled water, than can be dissolved in it. Boil it for half an hour in a Florence flask, or in a tin sauce-pan; let it stand to subside, and filter it through paper. My friend Mr. Greene, a surgeon at Brewood in Staffordshire, assured me, that he had cured in one season agues without number with this saturated solution; that he found ten drops from a two-ounce phial given twice a day was a full dose for a grown person, but that he generally began with five.

9. The manner, in which arsenic acts in curing intermittent fevers, cannot be by its general stimulus, because no intoxication or heat follows the use of it; nor by its peculiar stimulus on any part of the secreting system, since it is not in small doses succeeded by any increased evacuation, or heat, and must therefore exert its power, like other articles of the sorbentia, on the absorbent system. In what manner it destroys life so suddenly is difficult to understand, as it does

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not intoxicate like many vegetable poisons, nor produce fevers like contagious matter. When applied externally it seems chemically to destroy the part like other caustics. Does it chemically destroy the stomach, and life in consequence? or does it destroy the action of the stomach by its great stimulus, and life in consequence of the sympathy between the stomach and the heart? This last appears to be the most probable mode of its operation.

The success of arsenic in the cure of intermittent fevers I suspect to depend on its stimulating the stomach into stronger action, and thus, by the association of this viscus with the heart and arteries, preventing the torpor of any part of the sanguiferous system. I was led to this conclusion from the following considerations.

First. The effects of arsenic given a long time internally in small doses, or when used in larger quantities externally, seem to be similar to those of other great stimuli, as of wine or alcohol. These are a bloated countenance, swelled legs, hepatic tumours, and dropsy, and sometimes eruptions on the skin. The former of these I have seen, where arsenic has been used externally for curing the itch; and the latter appears on evidence in the famous trial of Miss Blandy at Chelmsford, about forty years ago.

Secondly. I saw an ague cured by arsenic in a child, who had in vain previously taken a very large quantity of bark with great regularity. And another case of a young officer, who had lived intemperately,
and

and laboured under an intermittent fever, and had taken the bark repeatedly in considerable quantities, with a grain of opium at night, and though the paroxysms had been thrice thus for a time prevented, they recurred in about a week. On taking five drops of a saturated solution of arsenic thrice a day the paroxysms ceased, and returned no more, and at the same time his appetite became much improved.

Thirdly. A gentleman about 65 years of age had for about ten years been subject to an intermittent pulse, and to frequent palpitations of his heart. Lately the palpitations seemed to observe irregular periods, but the intermission of every third or fourth pulsation was almost perpetual. On giving him four drops of a saturated solution of arsenic from a two-ounce phial about every four hours for one day, not only the palpitation did not return, but the intermission ceased entirely, and did not return so long as he took the medicine, which was three or four days.

Now as when the stomach has its action much weakened by an over-dose of digitalis, the pulse is liable to intermit; this evinces a direct sympathy between these parts of the system; and as I have repeatedly observed, that when the pulse begins to intermit in elderly people, that an eructation from the stomach, voluntarily produced, will prevent the threatened stop of the heart; I am induced to think, that the torpid state of the stomach, at the instant of the production of an eructation by its weak action, caused the intermission of the pulse. And that arsenic in this case, as

well

well as in the cases of agues above mentioned, produced its effects by stimulating the stomach into more powerful action; and that the equality of the motions of the heart was thus restored by increasing the excitement of the sensorial power of association. See Sect. XXV. 17. Class IV. 2. 1. 18.

10. Where arsenic has been given as a poison, it may be discovered in the contents of the stomach by the smell like garlic, when a few grains of it are thrown on a red-hot iron. 2. If a few grains are placed between two plates of copper, and subjected to a red heat, the copper becomes whitened. 3. Dissolve arsenic in water along with vegetable alkali, add to this a solution of blue vitriol in water, and the mixture becomes of a fine green, which gradually precipitates, as discovered by Bergman. 4. Where the quantity is sufficient, some wheat may be steeped in a solution of it, which given to sparrows or chickens will destroy them.

VII. Absorption of the matter from venereal ulcers. No ulcer can heal, unless the absorption from it is as great as the deposition in it. The preparations or oxydes of mercury in the cure of the venereal disease seem to act by their increasing the absorption of the matter in the ulcers it occasions; and that whether they are taken into the stomach, or applied on the skin, or on the surface of the ulcers. And thus in the same manner as sugar of lead, or
other

other metallic oxydes, promote so rapidly the healing of other ulcers by their external application; and probably when taken internally, as rust of iron given to children affected with scrophulous ulcers contributes to heal them, and solutions of lead were once famous in phthisis.

The matter deposited in large abscesses does not occasion hectic fever, till it has become oxygenated by being exposed to the open air, or to the air through a moist membrane; the same seems to happen to other kinds of matter, which produce fever, or which occasion spreading ulcers, and are thence termed contagious. See Class II. 1. 3. II. 1. 5. II. 1. 6. 6. This may perhaps occur from these matters not being generally absorbed, till they become oxygenated; and that it is the stimulus of the acid thus formed by their union with oxygen, which occasions their absorption into the circulation, and the fever, which they then produce. For though collections of matter, and milk, and mucus, are sometimes suddenly absorbed during the action of emetics or in sea-sickness, they are probably eliminated from the body without entering the circulation; that is, they are taken up by the increased action of one lymphatic branch, and evacuated by the inverted action of some other lymphatic branch, and thus carried off by stool or urine.

But as the matter in large abscesses is in general not absorbed, till it becomes by some means exposed to air, there is reason to conclude, that the stimulus of this new combination of the matter with oxygen occasions

sions its absorption; and that hence the absorption of matter in ulcers of all kinds, is still more powerfully effected by the external application or internal use of metallic oxydes; which are also acids consisting of the metal united with oxygen; and lastly, because venereal ulcers, and those of itch, and tinea, will not heal without some stimulant application; that is, the secretion of matter in them continues to be greater, than the absorption of it; and the ulcers at the same time continue to enlarge, by the contagion affecting the edges of them; that is, by the stimulus of the oxygenated matter stimulating the capillary vessels in its vicinity into actions similar to those of the ulcer, which produces it.

This effect of the oxydes of mercury occurs, whether salivation attends its use or not. Salivation is much forwarded by external warmth, when mercury is given to promote this secretion; but as the cure of venereal complaints depends on its absorbent quality, the act of salivation is not necessary or useful. A quarter of a grain of good corrosive sublimate twice a day will seldom fail of curing the most confirmed pox; and will as seldom salivate, if the patient be kept cool. A quarter of a grain thrice a day I believe to be infallible, if it be good sublimate.

Mercury alone when swallowed does not act beyond the intestines, its active preparations are the salts formed by its union with the various acids, as mentioned in the catalogue. Its union with the vegetable acid, when triturated with manna, is said to compose

Keyfer's Pill. Triturated with gum arabic it is much recommended by Plenck; and triturated with sugar and a little essential oil, as directed in a former Edinburgh Dispensatory, it probably forms some of the syrups sold as nostrums.

United with sulphur it seldom enters the circulation, as when cinnabar, or *Æthiops's* mineral, are taken inwardly. But united with fat and rubbed on the skin, it is readily absorbed. I know not whether it can be united to charcoal, nor whether it has been given internally when united with animal fat.

VIII. 1. Absorptions in general are increased by inanition; hence the use of evacuations in the cure of ulcers. Dr. Jurin absorbed in one night, after a day's abstinence and exercise, eighteen ounces from the atmosphere in his chamber; and every one must have observed, how soon his sheets became dry, after having been moistened by sweat, if he throws off part of the bed-clothes to cool himself; which is owing to the increased cutaneous absorption after the evacuation by previous sweat.

2. Now as opium is an universal stimulant, as explained in the article on *Incitantia*, it must stimulate into increased action both the secretory system, and the absorbent one; but after repeated evacuation by venesection, and cathartics, the absorbent system is already inclined to act more powerfully; as the blood-vessels being less distended, there is less resistance to
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the progress of the absorbed fluids into them. Hence after evacuations opium promotes absorption, if given in small doses, much more than it promotes secretion; and is thus eminently of service at the end of inflammations, as in pleurisy, or peripneumony, in the dose of four or five drops of the tincture, given before the access of the evening paroxysm; which I have seen succeed even when the risus sardonius has existed. Some convulsions may originate in the want of the absorption of some acrid secretion, which occasions pain; hence these diseases are so much more certainly relieved by opium after venesection or other evacuations.

IX. 1. Absorption is increased by the calces or solutions of mercury, lead, zinc, copper, iron, externally applied; and by arsenic, and by sulphur, and by the application of bitter vegetables in fine powder. Thus an ointment consisting of mercury and hog's fat rubbed on the skin cures venereal ulcers; and many kinds of herpetic eruptions are removed by an ointment consisting of 60 grains of white precipitate of mercury and an ounce of hog's fat.

2. The tumours about the necks of young people are often produced by the absorption of a saline or acrid material, which has been deposited from eruptions behind the ears, owing to deficient absorption in the surface of the ulcer, but which on running down on the skin below becomes absorbed, and swells the

the lymphatic glands of the neck; as the variolous matter, when inserted into the arm, swells the gland of the axilla. Sometimes the perspirative matter produced behind the ears becomes putrid from the want of daily washing them, and may also cause by its absorption the tumours of the lymphatics of the neck. In the former case the application of a cerate of lapis calaminaris, or of cerussa applied in dry powder, or of rags dipped in a solution of sugar of lead, increases the absorption in the ulcers, and prevents the effusion of the saline part of the secreted material. The latter is to be prevented by cleanliness.

After the eruptions or ulcers are healed a solution of corrosive sublimate of one grain to an ounce of water applied for some weeks behind the ear, and amongst the roots of the hair on one side of the head, where the mouths of the lymphatics of the neck open themselves, frequently removes these tumours.

3. Linen rags moistened with a solution of half an ounce of sugar of lead to a pint of water applied on the erysipelas on anasarctous legs, which have a tendency to mortification, is more efficacious than other applications. White vitriol six grains dissolved in one ounce of rose-water removes inflammation of the eyes after evacuation more certainly than solutions of lead. Blue vitriol two or three grains dissolved in an ounce of water cures ulcers in the mouth, and other mucous membranes, and a solution of arsenic externally applied cures the itch, but requires great caution in the use of it. See Class II. 1. 5. 6.

4. Bitter vegetables, as the Peruvian bark, quilted between two shirts, or strewed in their beds, will cure the ague in children sometimes. Iron in solution, and some bitter extract, as in the form of ink, will cure one kind of herpes called the ringworm. And I have seen seven parts of bark in fine powder mixed with one part of cerufs, or white lead, in fine powder, applied dry to scrophulous ulcers, and renewed daily, with great advantage.

5. To these should be added electric sparks and shocks, which promote the absorption of the vessels in inflamed eyes of scrophulous children; and disperse, or bring to suppuration, scrophulous tumours about the neck. For this last purpose smart shocks should be passed through the tumours only, by inclosing them between two brass knobs communicating with the external and internal coating of a charged phial. See Art. II. 2. 2. 2.

X. 1. Bandages increase absorption, if they are made to fit nicely on the part; for which purpose it is necessary to spread some moderately adhesive plaster on the bandage, and to cut it into tails, or into shreds two inches wide; the ends are to be wrapped over each other; and it must be applied when the part is least tumid, as in the morning before the patient rises, if on the lower extremities. The emplastrum de minio made to cover the whole of a swelled leg in this manner, whether the swelling is hard, which is usually termed scorbutic; or more easily compressible, as in anasarca,

anasarca, reduces the limb in two or three days to its natural size; for this purpose I have sometimes used carpenter's glue, mixed with one twentieth part of honey to prevent its becoming too hard, instead of a resinous plaster; but the minium plaster of the shops is in general to be preferred. Nothing so much facilitates the cure of ulcers in the legs, as covering the whole limb from the toes to the knee with such a plaster-bandage; which increases the power of absorption in the surface of the sore.

2. The lymph is carried along the absorbent vessels, which are replete with valves, by the intermitted pressure of the arteries in their neighbourhood. Now if the external skin of the limb be lax, it rises, and gives way to the pressure of the arteries at every pulsation; and thence the lymphatic vessels are subject to the pressure of but half the arterial force. But when the external skin is tightened by the surrounding bandage, and thence is not elevated by the arterial diastole, the whole of this power is exerted in compressing the lymphatic vessels, and carrying on the lymph already absorbed; and thence the absorbent power is so amazingly increased by bandage nicely applied. Pains are sometimes left in the fleshy parts of the thighs or arms, after the inflammation is gone, in the acute rheumatism, or after the patient is too weak for further evacuation; in this case after internal absorbent medicines, as the bark, and opiates, have been used in vain, I have successfully applied a plaster-bandage,

as above described, so as to compress the pained part.

XI. 1. We shall conclude by observing, that the sorbentia strengthen the whole habit by preventing the escape of the fluid part of the secretions out of the body, before it has given up as much nourishment, as it is capable; as the liquid part of the secretion of urine, sweat, saliva, and of all other secretions, which are poured into receptacles. Hence they have been said to brace the body, and been called tonics, which are mechanical terms not applicable to the living bodies of animals; as explained in Sect. XXXII
3. 2.

2. A continued use of bitter medicines for years together, as of Portland's powder, or of the bark, is supposed to induce apoplexy, or other fatal diseases. Two cases of this kind have fallen under my observation; the patients were both rather intemperate in respect to the use of fermented liquors, and one of them had been previously subject to the gout. As I believe the gout generally originates from a torpor of the liver, which instead of being succeeded by an inflammation of it, is succeeded by an inflammation of some of the joints; or by a pimpled face, which is another mode, by which the disease of the liver is terminated. I conceive, that the daily use of bitter medicine had in these patients prevented the removal of a gouty inflammation from the liver to the meninges
of

of the joints of the extremities, or to the skin of the face, by preventing the necessary torpor of these parts previous to the inflammation of them; in the same manner as cold fits of fever are prevented by the same medicines; and, as I believe, the returns of the gout have sometimes for two or three years been prevented by them.

One of these patients died of the apoplexy in a few hours; and the other of an inflammation of the liver, which I believe was called the gout, and in consequence was not treated by venesection, and other evacuations. From hence it appears, that the daily use of hop in our malt liquor must add to the noxious quality of the spirit in it, when taken to excess, and contribute to the production of apoplexy, or inflammation of the liver.

III. CATALOGUE OF THE SORBENTIA.

I. Sorbentia affecting the skin.

1. Acid of vitriol, of sea-salt, lemons, floes, prunus spinosa, crabs, pyrus, quince, pyrus cydonia, opium.
2. Externally calx of zinc, of lead, of mercury.

II. Sorbentia affecting the mucous membranes.

1. Juice of floes, crabs, Peruvian bark, cinchona, opium.
2. Externally blue vitriol.

III. Sorbentia affecting the cellu'ar membrane.

1. Peruvian bark, wormwoods, artemisia maritima, artemisia absinthium, worm-feed, artemisia fantonicum, chamomile, anthemis nobilis, tansey tanacetum, bogbean, menyanthes trifoliata, centaury, gentiana centaurium, gentian, gentiana lutea, artichoke-leaves, cynara scolymus, hop, humulus lupulus.
2. Orange-peel, cinnamon, nutmeg, mace.
3. Vomits, squill, digitalis, tobacco.
4. Bath of warm air, of steam.

IV. Sorbentia affecting the veins.

1. Water-crefs, fifymbrium, nasturtium aquaticum, mustard, finapis, scurvey-grafs cochlearia hortensis, horfe-radish cochlearia armoracia, cuckoo-flower, cardamine, dog's-grafs, dandelion, leontodon taraxacon, cellery apium, cabbage brassica.
2. Chalybeates, bitters, and opium, after sufficient evacuation.
3. Externally vinegar, friction, electricity.

V. Sorbentia affecting the intestines.

1. Rhubarb, rheum palmatum, oak-galls, gallæ quercinæ, tormentil, tormentilla erecta, cinquefoil potentilla, red-roses, uva ursi, simarouba.
2. Logwood, hæmatoxylum campechianum, fucus acaciæ, dragon's blood, terra japonica, mimosa catechu.

3. Alum

3. Alum, earth of alum, Armenian bole, chalk, creta, crab's claws, *chelæ cancrorum*, white clay, cimolia, calcined hartshorn, *cornu cervi calcinatum*, bone-ashes.

VI. Sorbentia affecting the liver, stomach, and other viscera. Rust of iron, filings of iron, salt of steel, *sal martis*, blue vitriol, white vitriol, calomel, emetic tartar, sugar of lead, white arsenic.

VII. Sorbentia affecting venereal ulcers. Mercury dissolved or corroded by the following acids :

1. Dissolved in vitriolic acid, called turpeth mineral, or *hydrargyrus vitriolatus*.
2. Dissolved in nitrous acid, called *hydrargyrus nitratus ruber*.
3. Dissolved in muriatic acid, *mercurius corrosivus sublimatus*, or *hydrargyrus muriatus*.
4. Corroded by muriatic acid. Calomel.
5. Precipitated from muriatic acid, *mercurius precipitatus albus*, *calx hydrargyri alba*.
6. Corroded by carbonic acid? The black powder on crude mercury.
7. Calcined, or united with oxygen.
8. United with animal fat, mercurial ointment.
9. United with sulphur. Cinnabar.
10. Partially united with sulphur. *Æthiops mineral*.
11. Divided by calcareous earth. *Hydrargyrus cum cretâ*.

12. Divided by vegetable mucilage, by sugar, by balsams.

VIII. Sorbentia affecting the whole system. Evacuations by venesection and catharsis, and then by the exhibition of opium.

IX. Sorbentia externally applied.

1. Solutions of mercury, lead, zinc, copper, iron, arsenic; or metallic calces applied in dry powder, as cerussa, lapis calaminaris.
2. Bitter vegetables in decoctions and in dry powders, applied externally, as Peruvian bark, oak bark, leaves of worm-wood, of tansey, camomile flowers or leaves.
3. Electric sparks, or shocks.

X. Bandage spread with emplastrum e minio, or with carpenter's glue mixed with one twentieth part of honey.

XI. Portland's powder, its continued use pernicious, and of hops in beer.

ART. V.

INVERTENTIA.

I. THOSE THINGS, which invert the natural order of the successive irritative motions, are termed invertentia.

1. Emetics invert the motions of the stomach, duodenum, and œsophagus.

2. Violent cathartics invert the motions of the lacteals, and intestinal lymphatics.

3. Violent errhines invert the nasal lymphatics, and those of the frontal and maxillary sinuses. And medicines producing nausea, invert the motions of the lymphatics about the fauces.

4. Medicines producing much pale urine, as a certain quantity of alcohol, invert the motions of the urinary absorbents; if the dose of alcohol is greater, it inverts the stomach, producing the drunken sickness.

5. Medicines producing cold sweats, palpitation of the heart, globus hystericus; as violent evacuations, some poisons, fear, anxiety, act by inverting the natural order of the vascular motions.

II. OB.

II. OBSERVATIONS ON THE INVERTENTIA.

I. 1. The action of vomiting seems originally to have been occasioned by disagreeable sensation from the distention or acrimony of the aliment; in the same manner as when any disgusting material is taken into the mouth, as a bitter drug, and is rejected by the retrograde motions of the tongue and lips; as explained in Class IV. 1. 1. 2. and mentioned in Sect. XXXV.

I. 3. Or the disagreeable sensation may thus excite the power of volition, which may also contribute to the retrograde actions of the stomach and œsophagus, as when cows bring up the contents of their first stomach to re-masticate it. To either of these is to be attributed the action of mild emetics, which soon cease to operate, and leave the stomach stronger, or more irritable, after their operation; owing to the accumulation of the sensorial power of irritation during its torpid or inverted action. Such appears to be the operation of ipecacuanha, or of antimonium tartarizatum, in small doses.

2. But there is reason to believe, that the stronger emetics, as digitalis, first stimulate the absorbent vessels of the stomach into greater action; and that the inverted motions of these absorbents next occur, pouring the lymph, lately taken up, or obtained from other lymphatic branches, into the stomach: the quantity of which in some diseases, as in the cholera morbus,

morbus, is inconveivable. This inverted motion, first of the absorbents of the stomach, and afterwards of the stomach itself, seems to originate from the exhaustion or debility, which succeeds the unnatural degree of action, into which they had been previously stimulated. An unusual defect of stimulus, as of food without spice or wine in the stomachs of those, who have been much accustomed to spice or wine, will induce sickness or vomiting; in this case the defective energy of the stomach is owing to defect of accustomed stimulus; while the action of vomiting from digitalis is owing to a deficiency of sensorial power, which is previously exhausted by the excess of its stimulus. See Sect. XXXV. 1. 3. and Class IV. 1. 1. 2.

For first, no increase of heat arises from this action of vomiting; which always occurs, when the fecerning system is stimulated into action. Secondly, the motions of the absorbent vessels are as liable to inversion as the stomach itself; which last, with the œsophagus, may be considered as the absorbent mouth and belly of that great gland, the intestinal canal. Thirdly, the class of forbentia, as bitters and metallic salts, given in large doses, become invertentia, and vomit, or purge. And lastly, the sickness and vomiting induced by large potations of wine, or opium, does not occur till next day in some people, in none till some time after their ingurgitation. And tincture of digitalis in the dose of 30 or 60 drops, though applied in solution, is a considerable time before it produces its effect; though vomiting is instantaneously induced by

a nauseous idea, or a nauseous taste in the mouth. At the same time there seem to be some materials, which can immediately stimulate the stomach into such powerful action, as to be immediately succeeded by paralysis of it, and consequent continued fever, or immediate death; and this without exciting sensation, that is, without our perceiving it. Of these are the contagious matter of some fevers swallowed with the saliva, and probably a few grains of arsenic taken in solution. See Suppl. I. 8. 8. Art. IV. 2. 6. 9.

3. Some branches of the lymphatic system become inverted by their sympathy with other branches, which are only stimulated into too violent absorption. Thus when the stomach and duodenum are much stimulated by alcohol, by nitre, or by worms, in some persons the urinary lymphatics have their motion inverted, and pour that material into the bladder, which is absorbed from the intestines. Hence the drunken diabetes is produced; and hence chyle is seen in the urine in worm cases.

When on the contrary some branches of the absorbent systems have their motions inverted in consequence of the previous exhaustion of their sensorial power by any violent stimulus, other branches of it have their absorbent power greatly increased. Hence continued vomiting, or violent cathartics, produce great absorption from the cellular membrane in cases of dropsy; and the fluids thus absorbed are poured into the stomach and intestines by the inverted motions of the lacteals and lymphatics. See Sect. XXIX. 4. and 5.

4. The

4. The quantity of the dose of an emetic is not of so great consequence as of other medicines, as the greatest part of it is rejected with the first effort. All emetics are said to act with greater certainty when given in a morning, if an opiate had been given the night before. For the sensorial power of irritation of the stomach had thus been in some measure previously exhausted by the stimulus of the opium, which thus facilitates the action of the emetic; and which, when the dose of opium has been large, is frequently followed on the next day by spontaneous sickness and vomitings, as after violent intoxication.

Ipecacuanha is the most certain in its effect from five grains to thirty; white vitriol is the most expeditious in its effect, from twenty grains to thirty dissolved in warm water; but emetic tartar, antimonium tartarizatum, from one grain to four to sane people, and from thence to twenty to insane patients, will answer most of the useful purposes of emetics; but nothing equals the digitalis purpurea for the purpose of absorbing water from the cellular membrane in the anasarca pulmonum, or hydrops pectorus. See Art. II. 3. 7.

II. Violent cathartics. 1. Where violent cathartics are required, as in dropsies, the squill in dried powder made into small pills of a grain, or a grain and a half, one to be given every hour till they operate briskly, is very efficacious; or half a grain of emetic tartar dissolved in an ounce of pepper-mint-water, and given every hour, till it operates. Scammony, and other
strong

strong purges, are liable to produce hypercatharsis, if they are not nicely prepared, and accurately weighed, and are thence dangerous in common practice. Gamboge is uncertain in its effects, it has otherwise the good property of being tasteless; and on that account some preparation of it might be useful for children, by which its dose could be ascertained, and its effects rendered more uniform.

2. In inflammation of the bowels with constipation, calomel, given in the dose from ten to twenty grains after due venesection, is most efficacious; and if made into very small pills is not liable to be rejected by vomiting, which generally attends those cases. When this fails, a grain of aloes every hour will find its way, if the bowel is not destroyed; and sometimes, I believe, if it be, when the mortification is not extensive. If the vomiting continues after the pain ceases, and especially if the bowels become tumid with air, which sounds on being struck with the finger, these patients seldom recover. Opiates given along with the cathartics I believe to be frequently injurious in inflammation of the bowels, though they may thus be given with advantage in the saturnine colic; the pain and constipation in which disease are owing to torpor or inactivity, and not to too great action.

III. Violent emetics and sialagogues. 1. Turpeth mineral in the quantity of one grain mixed with ten grains of sugar answers every purpose to be expected from

from errhines. Their operation is by inverting the motions of the lymphatics of the membrane, which lines the nostrils, and the caverns of the forehead and cheeks; and may thence possibly be of service in the hydrocephalus internus.

Some other violent errhines, as the powder of white hellebore, or Cayan pepper, diluted with some less acrid powder, are said to cure some cold or nervous head-achs; which may be effected by inflaming the nostrils, and thus introducing the sensorial power of sensation, as well as increasing that of irritation; and thus to produce violent action of the membranes of the nostrils, and of the frontal and maxillary sinuses, which may by association excite into action the torpid membranes, which occasion the head-ach.

2. A copious salivation without any increase of heat often attends hysteric diseases, and fevers with debility, owing to an inversion of the lymphatics of the mouth, see Class I. 1. 2. 6. The same occurs in the nausea, which precedes vomiting; and is also excitable by disagreeable tastes, as by squills, or by nauseous smells, or by nauseous ideas. These are very similar to the occasional discharge of a thin fluid from the nostrils of some people, which recurs at certain periods, and differs from defective absorption.

IV. Violent diuretics. 1. If nitre be given from a dram to half an ounce in a morning at repeated draughts, the patient becomes sickish, and much pale
water

water is thrown into the bladder by the inverted action of the urinary lymphatics. Hence the absorption in ulcers is increased and the cure forwarded, as observed by Dr. Rowley.

2. Cantharides taken inwardly so stimulate the neck of the bladder as to increase the discharge of mucus, which appears in the urine; but I once saw a large dose taken by mistake, not less than half an ounce or an ounce of the tincture, by which I suppose the urinary lymphatics were thrown into violent inverted motions, for the patient drank repeated draughts of subtepid water to the quantity of a gallon or two in a few hours; and during the greatest part of that time he was not I believe two entire minutes together without making water. A little blood was seen in his water the next day, and a forenefs continued a day longer without any other inconvenience.

3. The decoction of foxglove should also be mentioned here, as great effusions of urine frequently follow its exhibition. See Art. IV. 2. 3. 7. And an infusion or tincture of tobacco as recommended by Dr. Fowler of York.

4. Alcohol, and opium, if taken so as to induce slight intoxication, and the body be kept cool, and much diluting liquids taken along with them, have a similar effect in producing for a time a greater flow of urine, as most intemperate drinkers must occasionally

have observed. This circumstance seems to have introduced the use of gin, and other vinous spirits as a diuretic, unfortunately in the gravel, amongst ignorant people; which disease is generally produced by fermented or spirituous liquors, and always increased by them.

5. Fear and anxiety are well known to produce a great frequency of making water. A person, who believed he had made a bad purchase concerning an estate, told me, that he made five or six pints of water during a sleepless night, which succeeded his bargain; and it is usual, where young men are waiting in an anti-room to be examined for college preferment, to see the chamber-pot often wanted.

V. Cold sweats about the head, neck, and arms, frequently attend those, whose lungs are oppressed, as in some dropsies and asthma. A cold sweat is also frequently the harbinger of death. These are from the inverted motions of the cutaneous lymphatic branches of those parts.

III. CATALOGUE OF INVERTENTIA.

- I. Emetics, ipecacuanha, emetic tartar, antimonium tartarifatum, squill, scilla maritima, carduus benedictus, cnicus acarna, chamœmile, anthemis nobilis, white vitriol, vitriolum zinci, foxglove, digitalis purpurea, clysters of tobacco.
- II. Violent cathartics, emetic tartar, squill, buckthorn, rhamnus catharticus, scammonium, convolvulus scammonia, gamboge, elaterium, colocynth, cucumis colocynthis, veratrum.
- III. Violent errhines and sialagogues, Turpeth mineral, hydragyrum vitriolatum, asarum europæum, euphorbium, capficum, veratrum, nauseous smells, nauseous ideas.
- IV. Violent diuretics, nitre, squill, seneka, cantharides, alcohol, foxglove, tobacco, anxiety.
- V. Cold sudorifics, poisons, fear, approaching death.

ART. VI.

REVERTENTIA.

I. THOSE THINGS, which restore the natural order of the inverted irritative motions, are termed Revertentia.

1. As musk, castor, asafoetida, valerian, essential oils.

2. Externally the vapour of burnt feathers, of volatile salts, or oils, blisters, sinapisms.

These reclaim the inverted motions without increasing the heat of the body above its natural state, if given in their proper doses, as in the globus hystericus, and palpitation of the heart.

The incitantia revert these morbid motions more certainly, as opium and alcohol: and restore the natural heat more; but if they induce any degree of intoxication, they are succeeded by debility, when their stimulus ceases.

II. OBSERVATIONS ON THE REVERTENTIA.

I. The hysteric disease is attended with inverted motions feebly exerted of the œsophagus, intestinal canal and lymphatics of the bladder. Hence the borborigmi, or rumbling of the bowels, owing to their fluid contents descending as the air beneath ascends. The globus hystericus consists in the retrograde motion of the œsophagus, and the great flow of urine from that of the lymphatics spread on the neck of the bladder; and a copious salivation sometimes happens to these patients from the inversion of the lymphatics of the mouth; and palpitation of the heart owing to weak or incipient inversion of its motions; and syncope, when this occurs in its greatest degree.

These hysteric affections are not necessarily attended with pain; though it sometimes happens, that pains, which originate from quiescence, afflict these patients, as the hemicrania, which has erroneously been termed the clavus hystericus; but which is owing solely to the inaction of the membranes of that part, like the pains attending the cold fits of intermittents, and which frequently returns like them at very regular periods of time.

Many of the above symptoms are relieved by musk, castor, the fœtid gums, valerian, oleum animale, oil of amber, which act in the usual dose without heating the body. The pains, which sometimes attend these constitutions,

constitutions, are relieved by the fecernentia, as essential oils in common tooth-ach, and balsam of Peru in the flatulent colic. But the incitantia, as opium, or vinous spirit, reclaim these morbid inverted motions with more certainty, than the fœtids; and remove the pains, which attend these constitutions, with more certainty than the fecernentia; but if given in large doses, a debility and return of the hysteric symptoms occurs, when the effect of the opium or alcohol ceases. Opiates and fœtids joined seem best to answer the purpose of alleviating the present symptoms; and the forbentia, by stimulating the lymphatics and lacteals into continued action, prevent a relapse of their inversion, as Peruvian bark, and rust of iron. See Class I. 3. 1. 10.

II. Vomiting consists in the inverted order of the motions of the stomach, and œsophagus; and is also attended with the inverted motions of a part of the duodenum, when bile is ejected; and of the lymphatics of the stomach and fauces, when nausea attends, and when much lymph is evacuated. Permanent vomiting is for a time relieved by the incitantia, as opium or alcohol; but is liable to return, when their action ceases. A blister on the back, or on the stomach, is more efficacious for restraining vomiting by their stimulating into action the external skin, and by sympathy affecting the membranes of the stomach. In some fevers attended with incessant vomiting Sydenham advised the patient to put his

head under the bed-clothes, till a sweat appeared on the skin, as explained in Clafs IV. 1. 1. 3.

In chronical vomiting I have observed crude mercury of good effect in the dose of half an ounce twice a day. The vomitings, or vain efforts to vomit, which sometimes attend hysteric or epileptic patients, are frequently instantly relieved for a time by applying flour of mustard-seed and water to the small of the leg; and removing it, as soon as the pain becomes considerable. If sinapisms lie on too long, especially in paralytic cases, they are liable to produce troublesome ulcers. A plaster or cataplasm, with opium and camphor on the region of the stomach, will sometimes revert its retrograde motions.

III. Violent catharsis, as in diarrhœa or dysentery, is attended with inverted motions of the lymphatics of the intestines, and is generally owing to some stimulating material. This is counteracted by plenty of mucilaginous liquids, as solutions of gum arabic, or small chicken broth, to wash away or dilute the stimulating material, which causes the disease. And then by the use of the intestinal forbentia, Art. IV. 2. 5. as rhubarb, decoction of logwood, calcined hartshorn, Armenian bole; and lastly, by the incitantia, as opium.

IV. The diabetes consists in the inverted motions of the urinary lymphatics, which is generally I suppose owing to the too great action of some other
branch

branch of the absorbent system. The urinary branch should be stimulated by cantharides, turpentine, resin (which when taken in large doses may possibly excite it into inverted action), by the sorbentia and opium. The intestinal lymphatics should be rendered less active by torpentina, as calcareous earth, earth of alum; and those of the skin by oil externally applied over the whole body; and by the warm-bath, which should be of 96 or 98 degrees of heat, and the patient should sit in it every day for half an hour.

V. Inverted motions of the intestinal canal with all the lymphatics, which open into it, constitute the ileus, or iliac passion; in which disease it sometimes happens, that clysters are returned by the mouth. After venesection from ten grains to twenty of calomel made into very small pills; if this is rejected, a grain of aloe every hour; a blister; crude mercury; warm-bath; if a clyster of iced water?

Many other inverted motions of different parts of the system are described in Class I. 3. and which are to be treated in a manner similar to those above described. It must be noted, that the medicines mentioned under number one in the catalogue of revertentia are the true articles belonging to this class of medicines. Those enumerated in the other four divisions are chiefly such things as tend to remove the stimulating causes, which have induced the inversion of the motions of the part, as acrimonious contents,

or inflammation, of the bowels in diarrhœa, diabetes, or in ileus. But it is probable after these remote causes are destroyed, that the fetid gums, musk, castor, and balsams, might be given with advantage in all these cases.

III. CATALOGUE OF REVERTENTIA.

I. Inverted motions, which attend the hysterical disease, are reclaimed, 1. By musk, castor. 2. By asafœtida, galbanum, saganænum, ammoniacum, valerian. 3. Essential oils of cinnamon, nutmeg, cloves, infusion of penny-royal, mentha, pulegium, peppermint, mentha piperita, ether, camphor. 4. Spirit of hartshorn, oleum animale, sponge burnt to charcoal, black-snuffs of candles, which consist principally of animal charcoal, wood-foot, oil of amber. 5. The incitantia, as opium, alcohol, vinegar. 6. Externally the smoke of burnt feathers, oil of amber, volatile salt applied to the nostrils, blisters, sinapisms.

II. Inverted motions of the stomach are reclaimed by opium, alcohol, blisters, crude mercury, sinapisms, camphor and opium externally, clysters with asafœtida.

III. Inverted motions of the intestinal lymphatics are reclaimed by mucilaginous diluents, and
by

by intestinal forbentia, as rhubarb, logwood, calcined hartshorn, Armenian bole; and lastly by incitantia, as opium.

IV. Inverted motions of the urinary lymphatics are reclaimed by cantharides, turpentine, rosin, the forbentia, and opium, with calcareous earth, and earth of alum, by oil externally, warm-bath.

V. Inverted motions of the intestinal canal are reclaimed by calomel, aloe, crude mercury, blisters, warm-bath, clysters with asafœtida, clysters of iced water? or of spring water further cooled by salt dissolved in water contained in an exterior vessel? Where there exists an intromission of the bowels in children, could the patient be held up for a time by the feet with his head downwards, or be laid with his body on an inclined plane with his head downwards, and crude mercury be injected as a clyster to the quantity of two or three pounds?

ART. VII.

TORPENTIA.

I. THOSE THINGS, which diminish the exertion of the irritative motions, are termed torpentia.

1. As mucus, mucilage, water, bland oils, and whatever possesses less stimulus than our usual food. Diminution of heat, light, sound, oxygen, and of all other stimuli; venesection, nausea, and anxiety.

2. Those things which chemically destroy acrimony, as calcareous earth, soap, tin, alkalies, in cardialgia; or which prevent chemical acrimony, as acid of vitriol in cardialgia, which prevents the fermentation of the aliment in the stomach, and its consequent acidity. Secondly, which destroy worms, as calomel, iron filings or rust of iron, in the round worms; or amalgama of quicksilver and tin, or tin in very large doses, in the tape-worms. Will ether in clysters destroy ascarides? Thirdly, by chemically destroying extraneous bodies, as caustic alkali, lime, mild alkali in the stone. Fourthly, those things which lubricate the vessels, along which extraneous bodies slide, as oil in the stone in the urethra, and to expedite the expectoration of hardened mucus; or which lessen the friction of the contents in the intestinal canal in dysentery or apthia, as calcined hartshorn, clay, Armenian bole, chalk, bone-ashes. Fifthly, such things as soften or extend
the

the cuticle over tumours, or phlegmons, 'as warm water, poultices, fomentations, or by confining the perspirable matter on the part by cabbage-leaves, oil, fat, bee's-wax, plasters, oiled silk, externally applied.

These decrease the natural heat and remove pains occasioned by excess of irritative motions.

II. OBSERVATIONS ON THE TORPENTIA.

I. As the torpentia consist of such materials as are less stimulating than our usual diet, it is evident, that where this class of medicines is used, some regard must be had to the usual manner of living of the patient both in respect to quantity and quality. Hence wounds in those, who have been accustomed to the use of much wine, are very liable to mortify, unless the usual potation of wine be allowed the patient. And in these habits I have seen a delirium in a fever cured almost immediately by wine; which was occasioned by the too mild regimen directed by the attendants. On the contrary in great inflammation, the subduction of food, and of spirituous drink, contributes much to the cure of the disease. As by these means both the stimulus from distention of the vessels, as well as that from the acrimony of the fluids, is decreased; but in both these respects the previous habits of diet of the patients must be attended to. Thus if tea be made stronger, than the patient has usually drank it, it belongs to the article sorbentia; if weaker, it belongs to the torpentia.

II. 2. Wa-

II. 2. Water in a quantity greater than usual diminishes the action of the system not only by diluting our fluids, and thence lessening their stimulus, but by lubricating the solids; for not only the parts of our solids have their sliding over each other facilitated by the interposition of aqueous particles; but the particles of mucaginous or saccharine solutions slide easier over each other by being mixed with a greater portion of water, and thence stimulate the vessels less.

At the same time it must be observed, that the particles of water themselves, and of animal gluten dissolved in water, as the glue used by carpenters, slide easier over each other by an additional quantity of the fluid matter of heat.

These two fluids of heat and of water may be esteemed the universal solvents or lubricants in respect to animal bodies, and thus facilitate the circulation, and the secretion of the various glands. At the same time it is possible, that these two fluids may occasionally assume an aerial form, as in the cavity of the chest, and by compressing the lungs may cause one kind of asthma, which is relieved by breathing colder air. An increased quantity of heat by adding stimulus to every part of the system belongs to the article *Incitantia*.

III. 3. 1. The application of cold to the skin, which is only another expression for the diminution of the degree of heat we are accustomed to, benumbs the
the

the cutaneous absorbents into inaction; and by sympathy the urinary and intestinal absorbents become also quiescent. The fecerning vessels continuing their action somewhat longer, from the warmth of the blood. Hence the usual secretions are poured into the bladder and intestines, and no absorption is retaken from them. Hence sprinkling the skin with cold water increases the quantity of urine, which is pale; and of stool, which is fluid; these have erroneously been ascribed to increased secretion, or to obstructed perspiration.

The thin discharge from the nostrils of some people in cold weather is owing to the torpid state of the absorbent vessels of the *membrana schneideriana*, which as above are benumbed sooner than those, which perform the secretion of the mucus.

The quick anhelation, and palpitation of the heart, of those, who are immersed in cold water, depends on the quiescence of the external absorbent vessels and capillaries. Hence the cutaneous circulation is diminished, and by association an almost universal torpor of the system is induced; thence the heart becomes incapable to push forwards its blood through all the inactive capillaries and glands; and as the terminating vessels of the pulmonary artery suffer a similar inaction by association, the blood is with difficulty pushed through the lungs.

Some have imagined, that a spasmodic constriction of the smaller vessels took place, and have thus accounted for their resistance to the force of the heart.

But

But there seems no necessity to introduce this imaginary spasm; since those, who are conversant in injecting bodies, find it necessary first to put them into warm water to take away the stiffness of the cold dead vessels; which become inflexible like the other muscles of dead animals, and prevent the injected fluid from passing.

All the same symptoms occur in the cold fits of intermittents; in these the coldness and paleness of the skin with thirst evince the diminution of cutaneous absorption; and the dryness of ulcers, and small secretion of urine, evince the torpor of the secreting system; and the anhelation, and coldness of the breath, shew the terminations of the pulmonary artery to be likewise affected with torpor.

After these vessels of the whole surface of the body both absorbent and secretory have been for a time torpid by the application of cold water; and all the internal secreting and absorbent ones have been made torpid from their association with the external; as soon as their usual stimulus of warmth is renewed, they are thrown into more than their usual energy of action; as the hands become hot and painful on approaching the fire after having been immersed some time in snow. Hence the face becomes of a red colour in a cold day on turning from the wind, and the insensible perspiration increased by repeatedly going into frosty air, but not continuing in it too long at a time.

2. When by the too great warmth of a room or of clothes the secretion of perspirable matter is much increased, the strength of the patient is much exhausted by this unnecessary exertion of the capillary system, and thence of the whole fecerning and arterial system by association. The diminution of external heat immediately induces a torpor or quiescence of these unnecessary exertions, and the patient instantly feels himself strengthened, and exhilarated; the animal power, which was thus wasted in vain, being now applied to more useful purposes. Thus when the limbs on one side are disabled by a stroke of the palsy, those of the other side are perpetually in motion. And hence all people bear riding and other exercises best in cold weather.

Patients in fevers, where the skin is hot, are immediately strengthened by cold air; which is therefore of great use in fevers attended with debility and heat; but may perhaps be of temporary disservice, if too hastily applied in some situations of fevers attended with internal topical inflammation, as in peripneumony or pleurisy, where the arterial strength is too great already, and the increased action of the external capillaries being destroyed by the cold, the action of the internal inflamed part may be suddenly increased, unless venesection and other evacuations are applied at the same time. Yet in most cases the application of cold is nevertheless salutary, as by decreasing the heat of the particles of blood in the cutaneous vessels, the stimulus of them, and the distention of the vessels becomes

comes considerably lessened. In external inflammations, as the small-pox, and perhaps the gout and rheumatism, the application of cold air must be of great service by decreasing the action of the inflamed skin, though the contrary is too frequently the practice in those diseases. It must be observed, that for all these purposes the application of it should be continued a long time, otherwise an increased exertion follows the temporary torpor, before the disease is destroyed.

3. After immersion in cold water or in cold air the whole system becomes more excitable by the natural degree of stimulus, as appears from the subsequent glow on the skin of people otherwise pale; and even by a degree of stimulus less than natural, as appears by their becoming warm in a short time during their continuance in a bath, of about 80 degrees of heat, as in Buxton bath. See Sect. XII. 2. 1. XXXII.

3. 3.

This increased exertion happens to the absorbent vessels more particularly, as they are first and most affected by these temporary diminutions of heat; and hence like the medicines, which promote absorption, the cold-bath contributes to strengthen the constitution, that is to increase its irritability; for the diseases attended with weakness, as nervous fevers and hysteric diseases, are shewn in Section XXXII. 2. 1. to proceed from a want of irritability, not from an excess of it. Hence the digestion is greater in frosty weather,

and the quantity of perspiration. For these purposes the application of cold must not be continued too long. For in riding a journey in cold weather, when the feet are long kept too cold, the digestion is impaired, and cardialgia produced.

4. If the diminution of external heat be too great, produced too hastily, or continued too long, the torpor of the system either becomes so great, that the animal ceases to live; or so great an energy of motion or orgasm of the vessels succeeds, as to produce fever or inflammation. This most frequently happens after the body has been temporarily heated by exercise, warm rooms, anger, or intemperance. Hence colds are produced in the external air by resting after exercise, or by drinking cold water. See Clás I. 2. 2. 1.

Frequent cold immersions harden or invigorate the constitution, which they effect by habituating the body to bear a diminution of heat on its surface without being thrown into such extensive torpor or quiescence by the consent of the vessels of the skin with the pulmonary and glandular system; as those experience, who frequently use the cold-bath. At first they have great anhelation and palpitation of heart at their ingress into cold water; but by the habit of a few weeks they are able to bear this diminution of heat with little or no inconvenience; for the power of volition has some influence over the muscles subservient to respiration, and by its counter efforts gradually prevents the quick breathing, and diminishes the associations

of the pulmonary vessels with the cutaneous ones. And thus though the same quantity of heat is subducted from the skin, yet the torpor of the pulmonary vessels and internal glands does not follow. Hence during cold immersion less sensorial power is accumulated, and in consequence, less exertion of it succeeds on emerging from the bath. Whence such people are esteemed hardy, and bear the common variations of atmospheric temperature without inconvenience. See Sect. XXXII. 3. 2.

IV. Venesection has a just title to be classed amongst the torpentia in cases of fever with arterial strength, known by the fulness and hardness of the pulse. In these cases the heat becomes less by its use, and all exuberant secretions, as of bile or sweat, are diminished, and room is made in the blood-vessels for the absorption of mild fluids; and hence the absorption also of new vessels, or extravasated fluids, the produce of inflammation, is promoted. Hence venesection is properly classed amongst the sorbentia, as like other evacuations it promotes general absorption, restrains hæmorrhages, and cures those pains, which originate from the too great action of the discerning vessels, or from the torpor of the absorbents. I have more than once been witness to the sudden removal of nervous head-achs by venesection, though the patient was already exhausted, pale, and feeble; and to its great use in convulsions and madness, whether the patient was strong or weak; which diseases are the consequence

quence of nervous pains ; and to its stopping long debilitating hæmorrhages from the uterus, when other means had been in vain essayed. In inflammatory pains, and inflammatory hæmorrhages, every one justly applies to it, as the certain and only cure.

V. When the circulation is carried on too violently, as in inflammatory fevers, those medicines, which invert the motions of some parts of the system, retard the motions of some other parts, which are associated with them. Hence small doses of emetic tartar, and ipecacuanha, and large doses of nitre, by producing nausea debilitate and lessen the energy of the circulation, and are thence useful in inflammatory diseases. It must be added, that if nitre be swallowed in powder, or soon after it is dissolved, it contributes to lessen the circulation by the cold it generates, like ice-water, or the external application of cold air.

VI. The respiration of air mixed with a greater proportion of azote than is found in the common atmosphere, or of air mixed with hydrogen, or with carbonic acid gas, so that the quantity of oxygen might be less than usual, would probably act in cases of inflammation with great advantage. In consumptions this might be most conveniently and effectually applied, if a phthical patient could reside day and night in a porter or ale brewery, where great quantities of those liquors were perpetually fermenting in vats or open barrels ; or in some great manufactory of wines from raisins or from sugar.

Externally the application of carbonic acid gas to cancers and other ulcers instead of atmospheric air may prevent their enlargement, by preventing the union of oxygen with matter, and thus producing a new contagious animal acid.

III. CATALOGUE OF TORPENTIA.

1. Venesection. Arteriotomy.
2. Cold water, cold air, respiration of air with less oxygen.
3. Vegetable mucilages.
 - a. Seeds.—Barley, oats, rice, young peas, flax, cucumber, melon, &c.
 - b. Gums.—Arabic, Tragacanth, Senegal, of cherry-trees.
 - c. Roots.—Turnip, potatoe, althea, orchis, snow-drop.
 - d. Herbs.—Spinach, brocoli, mercury.
4. Vegetable acids, lemon, orange, currants, gooseberries, apples, grape, &c. &c.
5. Animal mucus, hartshorn jelly, veal broth, chicken water, oil? fat? cream?
6. Mineral acids, of vitriol, nitre, sea-salt.
7. Silence, darkness.
8. Invertentia in small doses, nitre, emetic tartar, ipecacuanha given so as to induce nausea.
9. Antacids.—Soap, tin, alkalies, earths.

10. Medicines preventative of fermentation, acid of vitriol.
11. Anthelmintics.—Indian pink, tin, iron, cowhage, amalgama, smoak of tobacco.
12. Lithontriptics, lixiv. saponarium, aqua calcis, fixable air.
13. Externally, warm bath, and poultices, oil, fat, wax, plasters, oiled silk, carbonic acid gas on cancers, and other ulcers.

A D D E N D A.

Page 245, after line 15, please to add, 'Where the difficulty of breathing is very urgent in the croup, bronchotomy is recommended by Mr. Field.' Memoir of a Medical Society, London, 1773, Vol. 1W.

ADDITION.

INABILITY TO EMPTY THE BLADDER.

*To be introduced at the end of Class III. 2. 1. 6. on
Paralysis Vesicæ Urinariæ.*

AN inability to empty the bladder frequently occurs to elderly men, and is often fatal. This sometimes arises from their having too long been restrained from making water from accidental confinement in public society, or otherwise; whence the bladder has become so far distended as to become paralytic; and not only this, but the neck of the bladder has become contracted so as to resist the introduction of the catheter. In this deplorable case it has frequently happened, that the forcible efforts to introduce the catheter have perforated the urethra; and the instrument has been supposed to pass into the bladder when it has only passed into the cellular membrane along the side of it; of which I believe I have seen two or three instances; and afterwards the part has become so much inflamed as to render the introduction of the catheter into the bladder impracticable.

In this situation the patients are in imminent danger, and some have advised a trocar to be introduced into the bladder from the rectum; which I believe is generally followed by an incurable ulcer. One patient, whom I saw in this situation, began to make a spoonful
of

of water after six or seven days, and gradually in a few days emptied his bladder to about half its size, and recovered ; but I believe he never afterwards was able completely to evacuate it.

In this situation I lately advised about two pounds of crude quicksilver to be poured down a glass tube, which was part of a barometer tube, drawn less at one end, and about two feet long, into the urethra, as the patient lay on his back ; which I had previously performed upon a horse ; this easily passed, as was supposed, into the bladder ; on standing erect it did not return, but on kneeling down, and lying horizontally on his hands, the mercury readily returned ; and on this account it was believed to have passed into the bladder, as it so easily returned, when the neck of the bladder was lower than the fundus of it. But nevertheless as no urine followed the mercury, though the bladder was violently distended, I was led to believe, that the urethra had been perforated by the previous efforts to introduce a catheter and bougee ; and that the mercury had passed on the outside of the bladder into the cellular membrane.

As the urethra is so liable to be perforated by the forcible efforts to introduce the catheter, when the bladder is violently distended in this deplorable disease, I should strongly recommend the injection of a pound or two of crude mercury into the urethra to open by its weight the neck of the bladder previous to any violent or very frequent essays with a catheter whether of metal or of elastic resin.

L I N E S,
TO BE PLACED AT THE END OF
Z O O N O M I A.

By a Friend.

JAMQUE OPUS EXEGL.

The work is done!—nor Folly's active rage,
Nor Envy's self, shall blot the golden page;
Time shall admire, his mellowing touch employ,
And mend the immortal tablet, not destroy.

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A P P E N D I X.

NOTE ON FEVER.

THE author of the tragic drama holds ever in reserve, for his *closing scenes*, the utmost power and energy of his pen. In *these* he mostly gives a loose to all his fire, and, in a bolder torrent of pathos, indulges his accumulated feelings to flow. By this address of art the catastrophe of his piece is rendered much more impressive, the mind of the reader or spectator becomes more deeply interested in the action, and absorbed in the misfortunes of each character; and thus are the faults or deficiencies of preceding parts either palliated, excused, or forgotten.

Our author, in like manner, would appear, even while engaged in the difficulties of Zoonomia, to have still preserved, in a state of *inactivity*, an abundant store of acumen and ingenuity. Of this, we may presume, he contemplated an expenditure in the future Supplement to his work; not indeed for the purpose of throwing a defensive or an oblivious mantle over any preceding articles of his system, because of such mantle perhaps they seldom stand in need; but in order that that part which he held to be most interesting

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ing, as a point of medical science, might be finished by the highest exertion of his mind.

The part of his publication, to which I here allude, embraces and treats of a theory of fever, which its author denominates "the sympathetic," in order to distinguish it, as he informs us, from the "mechanical theory of Boerhaave; the spasmodic theory of Hoffman and of Cullen, and the putrid theory of Pringle." To this catalogue might he have added the simple, but apparently nameless, theory of Brown, and the *convulsive* theory of Rush, both of which differ, not a little, from that he has so ably attempted to propagate and to defend.

The conception and establishment of a just and defensible theory of fever, our author appears to have considered as an object equally important, interesting and difficult of successful execution. To contribute to the accomplishment of so desirable an end, has been doubtless with him a very principal aim throughout the whole of his work entitled *Zoonomia, or the Laws of Animal Life*. As preparatory to an entrance on this difficult and interesting subject, he has given in brief, yet minute and comprehensive detail, statements and descriptions of all the more partial diseases of the system of *man*, together with their modes of treatment, agreeably to the most modern and approved principles of the healing art. He may even be said to have previously considered almost all the essential symptoms of fever in a detached or insulated state, under the characters of local diseases. He has gone farther still,

and embraced, in his very comprehensive system of pathology, those combinations of symptoms which he considers as constituting different species of fever. These species he has arranged under the classes and orders to which he supposes they respectively belong.

Our author has indeed attempted, in the science of medicine, a reformation, or I should rather say a revolution, similar to what the philosophers of France have so happily effected in the science of chemistry. They have endeavoured to convey a knowledge of the nature and constituent parts of chemical substances through the medium of the names by which they are designated. He has attempted to communicate a knowledge of the proximate causes of diseases, not indeed by their names, (for the usual ones are mostly retained), but by their location or place of assignment in his pathological classification.

By subjoining to his descriptions of each more partial disease, and even to those of what he denominates different species of fever, succinct accounts of their philosophy, or of the causes from which their several symptoms result, he has gradually prepared the mind of the reader for the final evolution of the theory we are now about to consider.

We might here pause for a moment to reflect on the apparent propriety of Dr. Darwin's views relative to the nature, the magnitude, and the extent of febrile affection. He would seem to have considered fever as embracing within itself, or (if the expression be admissible) as capable of enclosing within its own pro-

lific matrix, many, if not most of the subordinate diseases to which the system of man is subjected. His entertainment of this belief we would infer, partly from his having completed his consideration of all other diseases, previously to his entrance on the elucidation of the theory of fever, and partly from the nature of his observations on certain local affections. The opinion appears to be in a great measure tenable and just. Fever when *violent* disseminates its ravages throughout every portion of the body, which other diseases invade only in part. Thus, for example, the alimentary canal and liver; the systems of blood-vessels, of lymphatics, of nerves and of muscles; the cellular membrane, with the various glands and external integuments of the body; the brain, the lungs, and the heart, are occasionally invaded by this gigantic and formidable disease.

I well know that those subordinate systems or parts of the body just enumerated, are not at all times co-temporary sufferers in consequence of an attack of fever; but I also know that febrile cases of such extensive influence do occasionally fall under the eye of the practitioner. It is certainly true, as noticed and ably illustrated by Dr. Rush in his fourth volume of Medical Inquiries and Observations, that there exist fevers of nothing more than very partial extent. Thus the bilious fever, or at least effects resulting from causes which generally give birth to bilious fever, are at times completely concentrated in the hepatic system. Hence the existence of genuine hepatitis without any preceding perceptible disorder

disorder either in the blood-vessels or indeed in any other part of the body. Colic is frequently nothing else than a bilious fever pouring the whole torrent of its power in a state of concentration on some particular portion of the alimentary canal. In this case any degree of unmasked and general fever which may eventually succeed to the primary visceral affection, may with undoubted propriety be denominated a fever of sympathy. Perhaps it might be just to consider the scrophula as a certain description of slow fever, in its early attack exclusively confined to the system of lymphatics. The analogy of its *history* and *progress* with those of genuine phthisis will furnish at least some slight degree of testimony in support of such a belief. The leprosy and other cutaneous affections prevailing for the most part in the warmer climates of our globe, have been viewed by many as nothing else than febrile affections expending their rage on the superficies of the body. If I mistake not, this opinion is advocated and defended by Doctor Rush, in his clinical lectures delivered in the University of Pennsylvania. It is a fact well known even to the most superficial observers, that during the prevalence of autumnal diseases in low and flat countries, many of the inhabitants who are exempt from severe and dangerous fits of illness, are notwithstanding attacked by diurnal head-achs and other periodical pains situated in various parts of the body. At the termination of the season of sickness these anomalous affections for the most part disappear, and seldom occur again

till the next return of an epidemic temperament or constitution of the atmosphere. May we not from these circumstances infer, that such complaints are nothing else than so many masked or recondite forms of the prevailing epidemic of the season and place? more especially as they seldom fail to yield to the same mode of treatment found most efficacious in cases of unmasked and general fever? These several circumscribed maladies may be considered as *fever* artfully lurking in an *ambushed state*, and prepared for a more open and daring assault, should the patients be subjected to excessive fatigue, or should they imprudently abandon themselves to intemperance and dissipation.

With the truth of these observations respecting the existence of a latent or local state of fever under various forms, Dr. Darwin appears to be duly acquainted and impressed. He has embraced and considered most, if not all, of such forms in different parts of his nosological system. But it is not the theory of such descriptions of fever which he has so ingeniously attempted in the valuable Supplement to his work. He has there endeavoured to shed light on the philosophy of fever, not confined to a part, but diffused over the whole of the living system, through the medium of sympathy. It must not however be forgotten, that our author appears to consider most, if not indeed all, fevers to be nothing more than local diseases in their nascent or original state. In the entertainment of this belief perhaps he is philosophically and accurately just. The causes of fever cannot be supposed to operate

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rate on the whole of the living system at once. Their immediate agency must be confined to particular parts. On these parts, therefore, and on these exclusively, do they primarily produce their pernicious effects. Thus, for instance, if the matter of contagion, or any other agent capable of producing fever, be accidentally swallowed, and brought into immediate contact with the internal surface of the stomach, this organ must be locally affected before any other part of the system can possibly suffer. The same thing may be said with respect to the skin, when subjected to the action of febrile causes: a local affection must necessarily exist before the system can be subjected to the ravages of fever. This is happily illustrated and confirmed by the phenomena attending inoculation for the small-pox. If inflammation and a pustule occur on the inoculated part, some degree of general fever seldom fails to be excited; but if no such local affection take place, we consider our attempt for the most part abortive, and do not expect any subsequent fever. I am therefore induced to believe with our author, that all fevers, or in other words, that *fever* (for perhaps it is an *unit*) is in its incipient or embryo state, nothing more than a *local affection*. Thus the human body is itself, at first, a simple, rude, perhaps a formless point, and assumes only by degrees that beautiful diversity, yet regularity of figure, which it exhibits in an adult state.

If then the first impressions of febrile causes produce nothing more than topical affections on the parts

to which they are immediately applied, it may be asked, on what principle, or through what influence, the ravages of *general fever* can supervene? The answer may be collected from the ingenious supplement to the preceding work—We are there informed that *fever* is a disease of association; and that it therefore travels from part to part of the human body, subject only to the control of the principles and laws of *sympathy*. It is there indirectly suggested to us, that were it not for the influence of the power of sympathy or association, the production of a general disease would be an impracticable event. For as no noxious power can be supposed to operate on every part of the human body at once, neither can its deleterious effects be more extensive than its immediate operation, unless communicated and diffused through the medium of sympathy. Without the aid of sympathy in what manner could an original impression on the stomach produce disorder in the arterial system, rouse into tumultuous commotion the heart, or excite the most painful sensations in the head? Without the influence of the power of sympathy, in what manner could a torpor or inactivity in the vessels of the feet, give rise to inflammation in the membrane investing the nose, fauces, and lungs? On what other principle, save the influence of sympathy, can we attempt an explanation of the uniform connection between the uterus and stomach, or the well known reciprocity of affection between the uterus and mammæ? Without the existence of a powerful sympathy of parts, in
what

what manner could a pain and slight enlargement of one testicle only, excite considerable sickness at stomach, and even involve the whole system in the fervor and tumult of fever? A most distressing and even dangerous case of this latter description constitutes at present one of the objects of my attention. Without a knowledge of the sympathy existing between particular parts and the whole of the living system, we would be at a loss to account for the production of general fever by any possible description of local injury, as punctures with a sword, gunshot wounds, or even the amputation of the larger limbs. In a word, without the existence and active mediation of sympathy or association, the system of man could not possibly be pervaded by *general diseases*, nor could physicians be possessed of the command of *general remedies*. Were it not for the circumstance of a sympathetic connection of parts, no remedy could have a power of extending its influence beyond the site of its immediate application. In this case we would be unconditionally precluded from the efficacy of external remedies in procuring relief from many internal morbid affections of the system. We would be no longer able to remove an inflammation of the pleura or lungs, by giving rise to vesication on the integuments of the thorax; nor could we any more relieve an obstinate vomiting, or retrograde action of the stomach, by the application of blisters to the ancles or wrists. Without the pervasive influence of sympathy, the application of setons, issues, and caustics

for the relief of many diseases of the system, could not have even the shadow of a rational existence. Nor would physicians be any longer able to triumph in the happy effects of cold applications to different parts of the body, in fevers of a malignant and dangerous nature. Deprived of the kind and constant mediation of sympathy, even the *warm-bath* itself would operate to little effect on the debilitated and suffering system of man.

But it is not external remedies *alone* that would suffer by the *extinction* of the power and influence of sympathy. The agency of *internal remedies* would, by such an event, be no less materially affected. It is a circumstance well known to physicians, that many medicines, when taken into the stomach, produce their effects on distant and very different parts of the system, in a much shorter time than is requisite for their absorption and conveyance to such parts, through the long and mazy channels of circulation. They must operate therefore solely through the medium of sympathy or association of parts. This would appear to be particularly the case with opium, with ether, with musk, with asafoetida, and perhaps I might add, with the whole of those articles generally arranged by writers on materia medica under the head of antispasmodics. A similar observation may be made, relative to by far the greater part of that class of medicines denominated *tonics*, from their supposed power of communicating firmness and strength to the human body. It is true indeed that these latter medicines
do

do not, like those of the former class, produce an instantaneous effect on the living system. Like them, however, they appear not to be converted into chyle, and in this form received into the volume of circulating fluids, and must therefore be, in a great measure, if not wholly, confined in their primary operation to the stomach alone. From this organ, as from a common fountain, are their effects communicated, through the medium of sympathy, to the most distant parts of the living body.

The present is not an improper occasion to observe, that the living system of man is an extended unit, and that sympathy may be considered as the unitizing principle. Were it not for this pervasive principle, no one part could be held as absolutely essential to the existence of another. The head, the stomach, and the heart, might then be viewed as so many inflated or distinct beings, not necessarily linked together by a reciprocity of dependencies and good offices. Well might we then, with some of the ancient philosophers, consider the lungs as a lesser animal, situated in the body of a larger, labouring exclusively for the purposes of its own contracted economy. To compare small things with great, sympathy would appear to be to the living body of man, what the Newtonian principle of gravitation is to the solar system. It serves as a powerful bond of union, and while it secures, in the most effectual manner, the existence and independence of the whole, preserves a mutual connection and necessary dependence between each of the
individual

individual parts. Before concluding my observations on this subject, I would beg leave to repeat, that as sympathy appears to be the great generalizing power of the living system of man, without its existence and influence we could neither be subjected to the attacks of general diseases, nor could we possibly avail ourselves of the exhibition of general remedies. Indeed our demand for such remedies would be wholly precluded; for as morbid affections could be only local, local remedies would be adequate to every possible purpose of the healing art—We may I think go farther, and even at present with confidence assert, that notwithstanding the existence and ever active power of sympathy, yet most if not all diseases are in their embryo or nascent state nothing more than mere local affections. Morbid causes, as already observed, must be local in their original application—they cannot possibly extend to and primarily impress every part of the system at once. The actual extent of their earliest effects cannot be paramount to that of their application or contact—Such morbid effects therefore must necessarily be local, but may be afterwards diffused throughout every part of the system through the medium of the laws of association or sympathy. These observations I consider, with Dr. Darwin, as peculiarly applicable to the phenomena and nature of *fever*. This formidable disease, which frequently commits such ravages on the shattered system of man, appears to be originally nothing more than a topical affection. But nurtured and conducted by the powerful

erful hand of sympathy, it generally makes rapid acquisitions of strength, and suffers finally no part of the body to escape the desolation of its inroads. Thus the embryo ripple in the lake, at first almost a viewless speck, expands by gradual progression from the centre, till the whole extent of the glassy surface partakes of the tremulous commotion. And thus may we denominate the *sympathetic theory* of fever delivered by Darwin not only *ingenious*; perhaps it is, at least in part, entitled to the higher epithet of *just*!

Having thus submitted to the eye of the reader a few preliminary and general observations, we will now take the liberty of soliciting his attention to a more particular consideration of the subject of fever. Here it would be a research neither useless nor uninteresting to travel back through the voluminous records of medical science, and inquire into the speculations and opinions of the physicians of former ages, relative to the nature of this formidable disease. But imperious circumstances preclude me at present from engaging in an investigation so extensive and laborious. More leisure, and much more learning than I have now at command, would be requisite for the satisfactory accomplishment of so very arduous a task. To the industry and enterprize of the physician more occupied in reading than in practice, must be consigned the office of collecting, arranging, and finally embodying the sum of the opinions of ancient medical writers, respecting the theory or nature of fever. It may not, however, be at all amiss to pay,
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on the present occasion, at least a transient attention to the febrile theories of certain distinguished characters in medicine, who have lived, practised, and written at a much more modern period.

At the close of the last, and the beginning of the present century, lived three men almost equally celebrated for genius, for learning, and for indefatigable attention to the cultivation and improvement of the healing art. I need scarcely inform the reader that Stahl, Boerhaave, and Hoffman are the medical characters to whom I allude. Each of those great physicians would seem to have directed the principal force of his attention to an ascertainment of the phenomena, and an investigation of the cause of fever, while each of them embraced a theory of the disease considerably different from those of the other two.

Of these theories that of Stahl appears to have been considerably more fanciful, visionary, and weak than those of his two illustrious co-temporaries. Notwithstanding this, its plausible and engaging simplicity, the animated and persuasive eloquence with which it was delivered, but perhaps above all, the indolence and ease in which it indulged its practical adherents, drew after it a numerous retinue of advocates, not only during the life of its author, but later than down to the middle of the current century. I believe it to be a fact, that even at the present day, Germany, and perhaps other places also, can still furnish physicians who zealously adhere to the Stahlian doctrine of fever. This acute and ingenious medical philosopher, fancied

to himself the guardianship and actual presence of a certain intelligent and preservative principle, extended to every part of the living system of man. This principle he designated by the name of "*anima medica*," or the medical soul. To the sedulous and wise exertions of this anima, or guardian principle, to expel from the body some noxious agent, he attributed most of the distressing phenomena and commotions of fever. This hypothetical notion, neither founded on experiment, nor deduced from accurate and just observation, led him to be extremely guarded, and even painfully timid, in the exhibition of remedies, lest he should unfortunately interfere with the well timed and curative efforts of his favourite principle. The belief in such a vague and fanciful doctrine of fever could not fail of giving birth to a very feeble and indolent species of practice. Such indeed was that pursued by the celebrated Stahl and his credulous followers. Their system of practice appears to have been literally a system of delay, and of strangely amusing themselves by remaining idle spectators of what they conceived to be a struggle for victory between their *anima medica*, and the cause of disease. Often—too often did they suffer the former to fall in the combat, without stepping forward with the slightest auxiliary efforts. This sect of physicians might, with more propriety, be denominated *medical lookers on*, than *medical practitioners*; for they appear to have been industrious, and perhaps accurate observers of human misery, rather than benevolent philosophers, anxious
and

and active to procure for their patients a speedy relief from the ravages of disease. The necessary result of such a system of practice, it requires in the reader no great depth of sagacity to descry. It consisted in the loss of patients, and, finally, in the loss of reputation and business.

Very different from that of Professor Stahl was the *febrile doctrine* of his co-temporary, the illustrious Boerhaave. As the former was by far too *metaphysical*, the latter seems to have diverged into the opposite extreme, and was perhaps fully as much too *mechanical*, in his theory of *fever*. Into this error he appears to have been led, in a great measure, by his uniform and strong attachment to the current philosophy of the period in which he lived. The immediate cause of fever he supposed to consist in a morbid remora, or *stagnation* of the humours of the body in the evanescent branches of the capillary vessels. This stagnation or stoppage of the fluids, Dr. Boerhaave seems to have derived from two several and distinct sources. Its principal cause he supposed to be a morbid lentor,* or coagulation of the humours them-

* In the appropriation of the term *lentor*, Dr. Boerhaave, and I think most of his followers, appear unfortunately to have neglected all definitude of expression, sometimes using it to denote a stagnation of the fluids in the extreme capillaries, and at other times to designate a thickening or coagulation of the fluids, which he considered as the leading cause of such stagnation. In the following brief observations relative to his theory of fever, I shall uniformly use it in the latter sense.

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selves, rendering them unfit for the purpose of circular movements through the minute capillary tubes; but he unquestionably alleged, that it might also be occasioned, in part, by a *spasm* or *contraction* of the extreme ramifications of the vascular system—From a late attentive examination of part of the writings of this great physician, I am inclined to believe, that his opponents, and perhaps I might also add his adherents, have not done him entire justice in the opinions they have formed, or at least in the statements they have given, respecting his favourite theory of fever. As well as I now recollect, they have all uniformly supposed him to have placed his proximate cause of fever wholly in a lentor or preternatural thickening of the humours of the body, and in the presence of other descriptions of morbid matter. They appear indeed to have considered and represented him as a most complete humoral pathologist, literally disregarding the solids in his inquiry into the origin or proximate cause of fever. That this, however, was by no means the case—that he did not suffer his attachment to the *humoral*, to absorb his whole attention, and render him quite regardless of the *solid* or *nervous*, pathology, will, I think, appear obvious to any one on a fair and candid examination of his aphorisms relative to the phenomena and cause of fever. From these aphorisms it would seem, that the febrile theory of Dr. Boerhaave was less simple than those of his co-temporaries Dr. Stahl or Dr. Hoffman, the latter of which was afterwards so warmly

2. advocated,

advocated, and so extensively diffused through Europe and America by the immense talents and industry of Dr. Cullen of Edinburgh. The former of these theories, as already observed, attributed all the phenomena or symptoms of fever to the prophylactic, or rather expulsive operations of a single principle, designated by the name of *anima medica*; while the latter, as will be more fully stated hereafter, derived them also immediately from a simple unity of cause, namely, a general spasm or contraction of the extreme capillaries of the system. Thus might Dr. Stahl be justly considered as simply a *metaphysical*, and Dr. Hoffman as a *solid* or *anti-humoral* pathologist. Dr. Boerhaave, on the other hand, appears to have been more complex in his views respecting the nature and cause of fever. He sought for the true pathology of this disease neither exclusively in the *solids* nor in the *fluids* of the body: His more comprehensive theory extended to, and actually embraced them both; for while he doubtless considered a lentor or morbid coagulation of the fluids as the leading cause in the production of fever, he at the same time admitted, that this cause might be assisted in its operation by a preternatural contraction or *cramp*, as he in one place terms it, of the extremities of the vascular system. A remora or stoppage of the thickened fluids in the finer ramifications of the blood-vessels, together with a quicker contraction of the heart, Dr. Boerhaave considered, to use his own words, as constituting the “essence or idea of every acute fever.” The preternatural

natural frequency of the contraction of the heart, he supposed to result from an undue impresson of the blood on this organ, in consequence of its partial stagnation in the evanescent extremities of the arteries and veins. The intentional and necessary effect of such contraction he alleged to be, a gradual comminution of the viscous blood, a progressive concoction of the morbid matter it contained, and a consequent restoration of this fluid to a state fitted for the important business of circulation. From these latter observations it would seem, that Dr. Boerhaave, no less than his co-temporary Dr. Stahl, considered fever as an effort of the living system to produce certain salutary alterations in the blood, and to prepare for future expulsion, certain noxious agents with which this fluid had become accidentally charged. These efforts, however, he does not appear to have viewed as under the immediate direction of any intelligent principle residing in, and watching over the system of man. If I mistake not, he attributed them in some measure, if not indeed principally, to a well known mechanical law of the uniform and necessary *reaction* * of matter. I cannot help observing, on the present occasion, that

* Respecting the truth and accuracy of the position here laid down, I must acknowledge that I cannot positively decide. Nor am I now able to remove the uncertainty under which I labour, not having it in my power, at the present moment, to lay my hand on that volume of the writings of Dr. Boerhaave, which contains an exposition of his views on this particular subject.

a belief in the doctrine of the curative powers of *nature*, seldom fails to lead physicians into a hesitating, weak, and highly inefficient practice. We had doubtless much better, as is ably inculcated on us in the writings and public lectures of Dr. Rush, wrest, in most cases, the business of cure wholly out of the hands of nature, and treat our patients agreeably to the principles and rules of art. Nor do I hesitate in believing, that we will be still more fully convinced of the propriety of this mode of practice, in proportion as our views relative to the nature and cause of fever shall eventually become more enlightened and just. Before dismissing this subject, it may not be improper to observe, that the ease with which this theory of fever appeared to solve all the phenomena of that disease, the eminence and authoritative influence of the school of medicine, where it was first taught, but perhaps above all, the very high and just celebrity of its author, gave it, for a considerable length of time, a decided ascendancy over all others in many, if not indeed in most, parts of Europe. Such was the vigour and extent of its diffusion, that it even overleapt the limits of the ocean, sunk deep into the medical mind of America, and can boast, down to the present day, the advocacy of many physicians educated and residing on this side the Atlantic.

Having thus hazarded a few observations on the febrile theory of Dr. Boerhaave, we would now beg leave to solicit, for a moment, the reader's attention to that taught by his rival co-temporary the celebrated

Hoffman.

Hoffman. What is denominated the *Spasmodic theory* of fever is generally supposed to have derived its birth from the active, the ingenious, and the very fruitful mind of this illustrious teacher of Medicine. Such allegation may possibly be true: It is only just however to observe, that it is very pointedly and positively contradicted by Dr. Ferriar, of Manchester, in his preface to a valuable little work entitled *Medical Histories and Reflections*. “The assertion,” says our author, “of a spasmodic state of the extreme vessels, in the cold stage of fevers, for example, commonly ascribed to Dr. Hoffman, was first made by Dr. Piens, in his comprehensive treatise *De Febre*.” Respecting this point of literary controversy I am not able to speak from my own immediate knowledge, having never had an opportunity of consulting the production of Dr. Piens, to which we are here referred. From the character, however, of Dr. Ferriar, as a man, remarkable for his accuracy, his candour, and his love of truth, I entertain not at present the shadow of a doubt, but that he is in possession of facts fully adequate to the support of the declaration he has made. Nor do I consider it as at all derogatory from the high reputation of Dr. Hoffman, to deny his having been the father of the spasmodic theory of fever,—a theory, the influence of which is gradually dissolving away beneath the sunshine of later discoveries, and which will, in future time, be looked on as nothing more than a superb and lasting monument of the talents of its author and its advocates, and of the enormous er-

rors, (not to say inconsistencies) of medical science. It may be considered as praise sufficient to allow, that from the pen of Dr. Hoffman this theory of fever received such support and elucidation, as to introduce it to the notice and recommend it to the particular consideration and patronage of the famous Dr. Cullen of Edinburgh.

Illustrated and supported by all the powers of a man in whom the world knew not which most to admire, his learning, his talents, his eloquence, or his urbanity,* a man to whom the attachment of his pupils appeared in some instances paramount even to their inbred love of life;† and taught in a medical school, at that time without a rival in the world, we have no ground for surprize at the ascendancy and dominion which the spasmodic theory of fever acquired. It became indeed for a time almost the idol of no inconsiderable portion of the medical world. Nor has its influence, though certainly yielding to the force of discovery, and sinking beneath the reiterated strokes of opposition, as yet by any means expired. It mingles itself hourly in the consultations of physicians, and it is unnecessary

* See an eulogium to the memory of Dr. Cullen delivered before the College of Physicians of Philadelphia, by Dr. Benjamin Rush.

† That I have not here subjected myself to the charge of the slightest exaggeration, will appear from the circumstance of one of the pupils of Dr. Cullen, having risked his life in a duel, by way of resentment against what he conceived to be an indignity thrown on the medical and scientific reputation of his master.

for me to add, that under a particular modification effected by certain alterations and amendments, it is still ably advocated and taught by the professor of the practice of medicine in the oldest and, by far, the most respectable medical school in America—A school which I flatter myself will, at no very distant period of time, become equal in celebrity, as there is reason to believe it is at present in real science and practical utility, to any that the nations of Europe can boast!

From the writings of Dr. Cullen being like the book of nature, in the hands of every one, and from the just illustration and ingenious support given to his system of physic by Dr. Kuhn, in the University of Pennsylvania, it would be in me superfluous to attempt, at present, an analysis and detail of his theory of fever. To suppose the medical reader unacquainted with this theory, would indeed be little less than to charge him with the most consummate ignorance respecting the science of his profession. I must here however beg indulgence while I state a few observations and strictures on the second chapter of Dr. Cullen's First Lines of the practice of physic, in which he favours the public with an exposition of his proximate cause of fever.

These strictural observations we would introduce by requesting the adherents and friends to the Cullenian doctrine of fever, not to take exception to any freedom of remark or liberty of language, we may on the present occasion assume. In whatever we may advance

we will doubtless be *respectful*; while in whatever we advance we will endeavour to be *just*. Nor will we conceive ourselves intitled to take even the shadow of umbrage, should any one think proper to submit to an examination equally critical and rigid, whatever opinions we may publicly avow either on the present or on any future occasion.

After prefacing this chapter with a very pertinent remark, respecting the difficulty of developing the proximate cause of fever, the doctor modestly declares that he does not “pretend to ascertain it in a manner that may remove every difficulty; but that he will only endeavour to make such an approach towards it, as he hopes may be of use in conducting the practice in that disease.”

Having thus introduced his subject, he proceeds to lay down, as the ground work of his subsequent reasonings, nothing more than a bare *presumptive* hypothesis. Let us do him the justice to hear him in his own words. “As the hot stage of fever,” says our illustrious professor, “is so constantly preceded by a cold stage, we *presume* that the latter is the cause of the former.” What an illy selected! what a frost-work foundation is here, for the support of a solid and massy superstructure! Instead of proceeding, as every practical philosopher ought, from the ascertainment of facts to the deduction of principles, our author here sets out with nothing more than what logicians denominate a *petitio principii*. He begins by considering as already established, what it was certainly his duty as a teacher of medical science to have endeavoured to prove

prove. In this he has *widely* (I had almost said *unpar-donably*) deviated from that logical accuracy and justness of reasoning, by which the writings of a philosopher should never fail to be characterized. But let us even grant him all he here *presumes* and wishes, and pass on to the consideration of certain subsequent parts of his investigation.

Here I am sorry to observe, that although we are presented with many just and highly important observations, yet we find also much to controvert, and not a little to condemn. For to pass in silence over his indefinite use of the expression "*the energy of the brain,*" an expression to which he appears in reality to have annexed no appropriate meaning; not to speak of his classing together, as if of a kindred nature, *contagion* and *cold*, *miasmata* and *fear*, causes opposite as light and darkness in their modes of operation on the human body; he has gone on to call in the agency and aid of a certain imaginary principle, which he denominates the "*vis medicatrix natureæ,*" and which is certainly sufficient alone to cast a shade of disrespect on the whole of his elaborate doctrine. A belief in the action and influence of such a principle in the living system of man, can, at the present day of science, be considered in no other light than as a relic of ancient superstition in medicine. In admitting the existence and operation of this *metaphysical* principle, (for such I conceive myself authorized to denominate it) Dr. Cullen appears in reality to have formed for himself a more complex theory of fever out of the

more simple ones previously taught by Doctors Stahl and Hoffman. For although the professor of Edinburgh wishes to be considered as not connecting intelligence with his *vis medicatrix naturæ*, yet does he attribute to this hypothetical principle, certain operations and effects which must inevitably proceed from an intelligent source. The truth of the matter appears to be, that the doctor finding his progress in a favourite speculation opposed by an obstacle, which common means were not in his view sufficient to remove, called in to his aid the agency of a hidden principle, the power of which as no one can pretend to calculate, he flatteringly hoped that no one would venture to deny. Thus the epic poet having plunged his adventurous hero into a situation from which he cannot possibly be extricated by the joint exertions of men, calls in the assistance of some friendly deity to facilitate his escape. And thus the politic and ambitious Alexander, finding all his efforts insufficient to untie the celebrated Gordian knot, drew his rapier and at a single blow severed the cord on which the knot was formed. Our author having enlisted under his banner this mysterious *vis medicatrix*, could be no longer at a loss with respect to the solution of any phenomenon that could possibly occur. For as he took the liberty of introducing this *principle* at all, he might, by the same rule of privilege, make its agency equal, and even superior, to the difficulty of every possible emergence. Accordingly we find him attributing to its operation and influence the phenomena of both the *cold* and *hot* stages of fever,

ver.--Strange indeed, that the operation of any *physical* cause should be immediately productive of effects so literally opposite! But although he did not acknowledge the circumstance in words, yet to me it appears obvious, that Dr. Cullen must have considered his *vis medicatrix* as possessing something more than the mere physical properties of matter—He has certainly spoken of its operations as if he held it possessed of *intelligence* and *volition*.

Not content with ascribing both the cold and hot stages of fever to the agency of the *vis medicatrix naturæ*, our author goes on further to conjure up, from the tomb of the medical system of Hoffman*, an imaginary phenomenon that he may deduce it also from the influence of this equally imaginary cause. I mean his supposed *spasmodic affection* of the extremities of the vascular system, an effect which he in like manner attributes to the action of the *vis medicatrix*. Thus are there three leading phenomena, all equally different from each other, which Dr. Cullen has, notwithstanding, thought proper to consider and represent as deriving existence from an unity of cause.

The next particular, in our author's complex and elaborate theory, to which I shall advert, is the *atony* which he supposes to exist in the extreme vessels of the human body. Though the opinion of the existence

* I have here spoken of Dr. Hoffman in the light in which he is generally represented, namely, as the original founder of the *spasmodic* theory of fever, without by any means vouching for the truth of the allegation.

of an atony in these vessels may be literally just, yet I must confess that to me it appears in no degree more probable in consequence of the arguments by which Dr. Cullen has attempted its establishment. Here, as in former parts, all is mere hypothesis, or at best superficial and tortured analogy. The following appears to be the sum and substance of the Doctor's reasoning on this subject. In many cases there seems to exist a sympathy, or correspondence of state and action, between the stomach and the superficies of the body. During the cold stage of fever, there generally occurs more or less sickness at stomach, which the learned professor supposed to result from an atony of the vessels of that organ. Hence he concluded that there must also exist an atony in the superficial vessels of the body, from whence the atony of the stomach was derived. If the hackneyed motto of "*ex nihilo nihil fit*," be true, it is certainly in like manner true, that from such *fanciful conceptions* (*opinions* I cannot call them), as those of our author to which I have briefly adverted, no solid and practical deductions can possibly be drawn. As by the influence and operation of a general and immutable law of nature, every thing begets issue in its own likeness, visionary speculations must give birth to visionary results.

By way of conclusion on this subject, I would observe in general, that among all the chains of serious reasoning to which I have ever attended, I do not now recollect any one more truly sophistical and inconclusive, than that of Dr. Cullen in elucidation and support

port of his *proximate* cause of fever. He felt his future fame deeply involved in the issue of his theory, and expended therefore the united exertions of all his powers for its permanent establishment. Such were the immensity of the professor's talents, ingenuity, and learning, that we may say of him, with respect to his doctrine of fever, what the Ghost of the fallen Hector declares of himself relating to the melancholy fate of his native city.

—————" Si Perg ma dextrâ
Defendi possent, etiam hâc defensa fuissent." *

But unfortunately for the permanency of his favourite system, it was not composed of materials sufficiently durable to withstand the shock of future advances in the science of medicine. So consummately weak and indefensible was it in its nature, that in attempting its establishment and support, he could only pile hypothesis on hypothesis, thus giving birth to a huge but unfounded fabric, ready to totter in ruin round its builder's hoary and venerable head.

Let not the reader conclude from what I have here advanced, that I am disposed to think lightly of the

* In English, something of the spirit and meaning of this nervous and celebrated quotation, might perhaps be, not inaptly, thus expressed.

Had not, where Gods in awful council join'd,
Th' eventful purpose swell'd each heavenly mind,
" By Grecian wiles that hapless Troy should fall,"
Even this right hand had proved her guardian wall.

C. C.

writings

writings of Dr. Cullen. Far—very far from it—I had almost denominated them my *Bible* in the science of medicine. I seldom open them without being furnished with additional light on the subjects of which they immediately treat. They contain indeed an immense fund of medical information, on which I am at all times delighted to draw. As sources of practical information relative to most diseases, perhaps they are second to nothing that has yet appeared either in the English or in any other language. All that I have advanced in the foregoing pages is pointed, not against the *practical*, but merely against the *speculative*, part of Dr. Cullen's treatise on the subject of fever.

The first serious and formal opposition which appears to have been made in Britain to the medical system of Dr. Cullen, originated with his co-temporary Dr. Brown of Edinburgh, a man not more remarkable for his genius, than for his enmity, his dissipation, and his misfortunes. Although this extraordinary character published a work which is generally denominated a *System of Medicine*, yet I confess I am not able satisfactorily to ascertain, from the most attentive examination of it, what were his precise views on the subject of fever.* The performance is however truly

* To say, as is mostly done, that Dr. Brown conceived the nature and essence of fever to consist wholly in *debility*, would perhaps be to advance an opinion which that teacher of medicine did not intend. I think it much more delicate, and it is certainly by far more candid and just, to acknowledge our ignorance

valuable, and has perhaps the additional merit of being, in parts, entirely *original*. It must, at least, be accounted an astonishing work in medicine, to have been written by a man who does not appear to have been remarkable for his literary connections, who *drank* so much, and who *practised* so little.*

The febrile theories of the celebrated Doctors Darwin and Rush, shall constitute, in the last place, the subject of a few observations and remarks. Here I beg leave to premise, that I neither mean to assume the *liberty*, nor to assert in myself an *ability*, to decide on the general and comparative merit of the writings of these two great physicians. Such an office would not only be indelicate, and justly offensive in its nature, but would be particularly inconsistent with propriety of conduct in a young, and comparatively an uninformed and inexperienced man. In point of delicacy, at least, it will be early enough to enter on such a disquisition, after the world shall have been deprived of the virtues and services of these two great and good men. Should I appear, however, in my

ignorance of an author's precise views, than to run any risque of misrepresenting his meaning. Though I am at a loss with respect to them, yet I do not mean to insinuate that others are not satisfactorily possessed of the opinions of Dr. Brown on the subject of fever.

* Dr. Brown was never at any time popular as a practical physician, but, particularly in the latter part of his life, business may be said to have entirely deserted him. Perhaps he died without a single patient under his care.

subsequent

subsequent consideration of their doctrines, to adopt and advocate, sometimes the particular opinions of the one, and sometimes those of the other, I flatter myself I may rest fully confident that an enlightened candour and liberality of sentiment, the never-failing growth of minds expanded by the ameliorating influence of science, will be my perfect security against the resentment of either.

As the high medical reputation of Dr. Darwin and Dr. Rush will doubtless cause their theories of fever to be very generally sought after and read, it would be superfluous in me, on the present occasion, to intrude on the time, and perhaps exhaust the patience, of the reader, by analysing either of them in minute and extensive detail.

On taking a general or collective view of the *febrile theories* of these two physicians, they appear to be respectively characterized by several principles and opinions very widely *different from*, not to say, directly *opposite to*, each other; while in other respects again they more nearly coincide. I shall point out in the following pages some of those particulars in which these theories most strikingly differ, and perhaps take the liberty of stating a few observations on each.

I. These two medical philosophers seem to differ radically in their views of what may be denominated the *essence* or *proximate cause* of fever. In other words, they differ most widely in their original definitions, or perhaps I might say descriptions, of this disease. Thus Dr. Darwin, in the beginning of his supplement

plement to the preceding work, defines fever as consisting in “the increase or diminution of direct or reverse associated motions,” without saying in what specific parts of the system these motions must be necessarily excited. While Dr. Rush, on the other hand, although in page 123 of his fourth volume of *Medical Inquiries and Observations*, he declines giving a definition of fever, in consideration, as he observes, of the many different forms under which it appears; yet in page 134 of the same volume, proceeds to lay down a brief generalisation of his views on the subject, by defining this disease to be “a convulsion in the sanguiferous, but more obviously, in the arterial system.” The difference between these two definitions of the same disease, are too strikingly obvious to demand any comment. I will here however take the liberty of stating, with deference, one or two remarks on the nature of the principal, I may indeed say the only evidence, which Dr. Rush has advanced in favour of the position, that fever is a *convulsion* in the arterial system. This evidence appears to be of a nature entirely *analogical*. This the Doctor himself very ingenuously acknowledges in the following passage, where alluding to the *convulsive* nature of fever he says, “That this is the case I infer from the strict *analogy* between symptoms of fever, and convulsions in the *nervous* system.”

Although in discussions respecting objects of science, I am for the most part an open enemy to criticisms on expressions or words; yet, on the present occasion,

I am

I am induced to deviate for a moment from the immediate track I had determined to pursue, for the purpose of suggesting the question, whether or not “convulsion in the *nervous* system,” be not an expression considerably exceptionable? With medical writers this expression is, I know, extremely common. But, in my view, the *commonness*, by no means establishes the *propriety*, of its use. Is it not calculated to misrepresent a fact, and thus to convey an error to the mind? Is it true that those convulsions, which Dr. Rush and other writers mean to designate by this expression, have their immediate seat in the *nervous*?—or, Are they not rather diseased affections of the *muscular*, system? To me I must confess they appear to be unequivocally of the latter description. For although it may be true, that the disease is produced entirely through the medium of the nerves, yet it is certainly the muscles which are eventually convulsed. I would by no means positively deny the existence of a synchronous affection of the nerves; but I am unable, for the most part, to discover any phenomenon to render such affection certain. Should it be observed that the affections to which the Doctor alludes may be denominated convulsions of the nervous system, because the nerves appear to be deeply instrumental and efficacious in their production; I would reply, that by the same rule of reference, they may be as properly denominated *convulsions of the brain*; because it is probably from this organ that the convulsive influence originally proceeds. Were such affections

fections represented as convulsions of the *muscular system*, perhaps the phraseology would be much less exceptionable, and would not contribute to the perpetuation of an error in the mind.*

* In a late conversation on the impropriety of this expression, it was alleged to me by an ingenious pupil of Dr. Rush, that that professor had, in his division of the human body into different systems, considered the muscles as constituting a part of the nervous system, and that it was therefore, in him, allowable and consistent, to denominate those muscular affections alluded to in the above paragraph, convulsions of the *nervous system*. This suggestion led me to consult the writings of Dr. Rush, to examine my manuscript notes taken during my attendance on his lectures, and also to interrogate my memory relative to the point immediately in question. But from neither of these sources have I been able to collect any substantial testimony in favour of the belief, that the Doctor considers the muscles as a part of the nervous system. Such an opinion I conceive to be indeed by far too fanciful to be entitled to the advocacy of this enlightened physician.

On what principle, I would beg leave to ask, can we be led to suppose, that the muscles constitute a part of the nervous system? Is it because the evanescent ramifications of nerves appear to be lost in, and incorporated with, the substance of the muscles? Or is it because these *latter* organs would seem to derive their susceptibility of stimulant impressions perhaps entirely through the medium of the *former*? If so, we are authorized by the same rule of induction to declare, that the arteries, the veins, and even the abdominal and other viscera, constitute, in like manner, so many different parts of the nervous system. Through each of these parts are the extremities of nerves most minutely distributed, and perhaps it is in consequence of this distribution alone, that such parts are rendered alive to the

Begging pardon of the reader for the length of this critical digression, I must now request him to accompany me in the remarks which I originally contemplated. The nature of the evidence adduced by Dr. Rush in support of his position, that fever is a *convulsion* in the vascular system is, as already observed, entirely *analogical*. It is indeed true that the Doctor has traced this analogy to a very considerable extent, having stated no less than nineteen particulars in which fever exhibits an obvious similitude to what he has denominated convulsions in the nervous system. But had the professor adduced tenfold the number of such particulars as these, the nature of the evidence would have been in no degree affected. It would have been *analogy* still. To a man possessing the expanded mind of Dr. Rush, it is surely needless for me to observe, that *facts*, and not *analogy*, constitute the only proper and secure foundation for the erection of systems, for the establishment of principles, or even for the formation of opinions, in science. Though analogy be confessedly a very fair and flowery, yet I am sorry to add, that in point of real science, it is but little better than a fruitless, field. Though it abound in mat-

ter of stimuli.—With an equal degree of propriety might we pronounce the muscles to constitute a part of the *vascular system*. Because muscles are known to be furnished with an abundant supply of both arteries and veins; and unless blood were conveyed to them through the former, and regularly returned through the latter, description of canals, disease, and death would be the necessary result.

ters

ters of imagery for the poet's creative imagination, and be rich in metaphor for the flowing tongue of the orator, yet can it furnish but little, very little aid to the philosopher's more accurate and deliberative pen.

From what I have here said, let it not be inferred that I mean to deny the doctrine of fever's being a *convulsion* in the vascular system—No such thing!—Perhaps the doctrine is accurately just. I only wish to insinuate, that the medical world may without impropriety hold themselves at liberty, at least, to suspend their opinion respecting the truth of a position, in support of which, the talents and ingenuity of the professor of the institutes of medicine in the University of Pennsylvania, were able to advance nothing but the evidence of *analogy*.*

* A medical friend of equal learning, acumen, and ingenuity, did me the favour of looking over the preceding observations relative to the convulsive action of the blood vessels in fever. After having considered them well, he suggested to me the *probability* of my not having done literal justice to Dr. Rush in alleging, that his only evidence exhibited in favour of the position, that fever is a *convulsion* in the arterial system, is nothing more than the evidence of *analogy*. This suggestion led me to a farther and more attentive examination of the Doctor's treatise on the proximate cause of fever. Nor, has such examination had the slightest tendency to make me change the ground I had originally chosen. I must still humbly conceive, that the professor's beautiful fabric of argumentation is exclusively built on the basis of analogy. It is true, indeed, he has told us that an *irregularity* of arterial action is easily discoverable by the

II. The next particular I shall mention in which Doctors Rush and Darwin differ with respect to their views of fever, relates to the *division* or *distinctions* of this disease. Thus, Dr. Rush declares fever to be a simple *unit*, and considers all the different forms under which it occasionally appears, as nothing more than particular *states* of the same original affection. But Dr. Darwin, on the other hand, views fever as divisible into several distinct species.

sense of touch. This observation is certainly founded on numerous and well established facts.—In fever the arterial action is, in most cases, truly *irregular*: But every irregularity of action does not necessarily constitute *convulsion*, agreeably to the common acceptation of the term. Conscious of the truth of this circumstance, the Doctor proceeds to attempt an establishment of the really *convulsive* nature of that irregularity of arterial action, which he considers as the proximate cause of fever. In this attempt he acknowledges himself, that he only treads on analogical ground. His own words will constitute the best testimony in favour of the truth of what I here advance. “This irregular action,” says the professor, “is in other words, a *convulsion* in the sanguiferous, but more obviously in the arterial system. That this is the case I infer from the strict *analogy* between symptoms of fever, and convulsions in the nervous system. I shall briefly mention the particulars in which this *analogy* takes place.”

From the short quotation, I hope and presume, it will appear sufficiently obvious, that I have neither intended, nor done, even the shadow of injustice to the real nature and spirit of Dr. Rush's reasoning on this intricate subject: but that, on the other hand, I have the unequivocal sanction of his own words, in considering the evidence he has offered as nothing more than the evidence of *analogy*.

His

His first, and most general division of fever, would appear to be that which contemplates this disease as either *irritative* or *sensitive*. Irritative fever he divides into *simple* and *compound*. Simple fever he again subdivides into what he calls "*febris irritata*," and "*febris inirritata*," his specific definitions of which, he has laid down in the supplement to the preceding work. Compound fever he has not divided into distinct species, but has declared it to be of different import and danger, accordingly as different parts of the system are arrested by torpor. As well, however, as I now recollect, a *torpor* of the *Stomach* appears to be with him a *causa sine qua non* of his compound description of fever. *Sensitive* fever is that in which there exists pain in consequence of the occurrence of actual and topical inflammation. Although Dr. Darwin has not spoken pointedly, respecting the divisibility of this description of fever; yet from the spirit and nature of his general plan, it is obvious that he must consider it as particularly modified by the occurrence of the inflammation in different parts of the body.

This point of difference in opinion between these two great men, may with propriety be considered as a subject peculiarly favourable for remark and discussion. I shall content myself, however, with simply observing, that the theory of Dr. Rush, by, lens-like, concentrating our views on the subject of fever, by confining our attention to a unity of cause, and, in some measure also, to a unity of effect, is well calculated for

introducing into the practice of medicine, a peculiarly bold and desirable *simplicity*. While, on the other hand, that of Dr. Darwin, by referring us to a much less definitive cause, and pointing us to a greater multiplicity of effects, tends more to *divide*, I had almost said to *distract*, the attention, and thus tends to give birth and continuance to a description of practice less simple, and perhaps I may add, in some cases, less energetic and just.

III. A third particular in which these two celebrated physicians differ widely in their views from each other, is that respecting the embryo or earliest stage of fever. Dr. Rush, for example, appears to consider fever, from the first dawning of its onset, as actually a disease of the *whole system*, and holds the arteries to be the part more immediately attacked. Thus in the fourth volume of his *Medical Inquiries and Observations*, page 135, he discloses his belief on this subject in the following words, "The stimuli which induce the irregular action or convulsion of fever, act for the most part, primarily upon the sanguiferous, and particularly, upon the arterial system." From this, taken in conjunction with other clauses which might be adduced from his writings, it is sufficiently evident that the Doctor considers fever as originally a *general* and *idiopathic* disease of the arterial system. Very different from this however is the belief of Dr. Darwin. He considers fever as a disease of sympathy or association, and holds it therefore to be, in its earliest invasion, nothing more than a *topical* affection. In no part, indeed, of his writings,

writings, as well as I now recollect, has he, in express and unequivocal terms, told us, that he views fever, in its first attack, as nothing more than a local disease. But no matter for that. Such a belief is wholly inseparable from that of its being a disease of sympathy. If it were not originally a *local* affection, in what manner could it possibly be communicated from part to part of the system, in subservience to the principles and laws of association? Such an event would be wholly impracticable. In consideration, therefore, of its original locality, and of such locality *alone*, can this event be presumed to take place. For were its first onset of general extent, it is needless to observe, that there would be no particular part exempt from disease, to which a subsequent communication by sympathy or association could be effected. It is therefore sufficiently obvious, that in the very nature of the belief of fever's being a disease of association or sympathy, is necessarily interwoven that of its being, in its earliest stage, nothing more than a local affection*.

* Should it be inquired, what advantage can eventually result from considering fever as originally a topical, and afterwards as a sympathetic disease? I answer, the advantage may probably be considerable. Such a doctrine tends to lead physicians to a more accurate investigation of the radical seats of fever, and consequently to a more judicious application of topical remedies, for the purpose of rendering them productive of general effects. This doctrine may also lead to successful *inoculation* in certain contagious fevers which are not at present communicated in that way.

I have already intimated that in this particular point of doctrine (however novel and erroneous it may appear to some) I am disposed to favour and adopt the opinion of the British physician. I have formerly

Perhaps the most rational explanation of the well known difference between the violence of the *inoculated* and *natural* small-pox, may be deduced from a knowledge of the intricate and interesting subject of sympathy. Dr. Darwin supposes that that particular description of small-pox denominated the *confluent*, results from the immediate lodgement of variolous matter in the stomach, because that viscus is possessed of such an extensive and powerful sympathy with the other parts of the body. The distinct small-pox, when communicated in the natural way, he considers as originating from the fixation and consequent action of the variolous contagion on the tonsils, or on some other part of the fauces or throat. The difference between the violence and danger of these two varieties of disease, our author very ingeniously considers as resulting from the difference between the sympathizing powers of the parts where the variolous matter is originally lodged. The stomach, for example, being the most powerful seat of sympathy, gives origin, when originally infected, to a confluent and dangerous variety of small-pox. Whereas the tonsils and throat, sympathizing less powerfully with the rest of the system, give rise, when infected, to a distinct and less formidable description of disease.

On the same principle may we attempt an explanation of the still superior mildness of the inoculated small-pox. That part of the body into which the matter of contagion is generally introduced, possesses but weak powers of sympathy with the system at large. The violence and danger of the subsequent disease would appear, therefore, to correspond in degree with the sympathizing power of the part on which the variolous contagion produced its earliest effects.

assigned, in part, the reasons by which I am principally influenced. It may not however be amiss to be somewhat more particular and explicit on this curious and interesting subject.

The last practical advantage I shall mention as likely to result from considering fever as originally a local affection, is the happy tendency which such consideration would probably have to induce patients to apply for medical aid at a very early period of this disease. Thus, for example, in cases of the bites of serpents, or of animals affected with *rabies canina*, the importance of an early application for relief is universally known and acknowledged. On what circumstance, I would beg leave to ask, is founded this acknowledgment of the supreme importance of such application? Is it not on that, of these melancholy affections being originally of nothing more than a local nature and extent? The poisons introduced into the wounds occasioned by the teeth of the animals are as yet, in their effects, confined to the seats of their immediate application, and have not produced, in the system at large, the ravages of *sympathetic action*. To prevent the occurrence of such action is the only desideratum necessary for the accomplishment of a cure. This prevention may be, perhaps for the most part, effected by early and well directed applications to the original affections, while still in a local state. But I need not add, that if the diseases be suffered to become general, through the medium of sympathy, they too often bid defiance to the best directed efforts of the healing art.

Similar observations may be made with respect to the subject of fever, especially of that which derives its origin from miasma or human contagion. Such fever is nothing else than the effect of a peculiar *poison* applied to a particular *part*, not extended over the *whole*, of the living system. To this part is its primary action confined, and constitutes, therefore, originally a local disease. This disease often retains its local character

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It is a maxim in physics, which will not, I presume, be denied, nor even controverted, that the primary and *immediate action* of a cause cannot, in *extent*, be paramount to *that* of the cause itself. This maxim is fairly deducible from the universally acknowledged truth, that a cause cannot *immediately act* where it does not positively *exist*. Thus, for example, the particles of acid and alkali do not act on, and neutralize each other, unless they be brought into immediate contact. The fragrance of a rose does not regale us beyond the sphere to which its odoriferous particles are wafted on the atmosphere. The fluid of light cannot discover to us any of the properties of surrounding objects, unless it be admitted into actual contact with the optic nerve. Nor can the subtle matter of heat raise the temperature, or augment the bulk of any part of a body, unless such part be subjected to the immediate impulse and action of its particles.

for a considerable time, as we have reason to believe from the period which not unfrequently elapses after the original application of the poison, before it appears under a general description or form. During the continuance of such locality is doubtless a very favourable time for the success of preventative applications. Were patients, during this eventful period, to apply for medical aid, and had physicians a perfect knowledge of the actual seat of disease (a knowledge no doubt in the power of observation to acquire) I have no hesitation in believing, that the direful effects of miasma or human contagion might be, at least, as certainly (perhaps I may say much more certainly) prevented, than those arising from the action of the poison of serpents, or of that of animals affected by canine madness.

In like manner, human contagion, miasmata resulting from the decomposition of animal and vegetable substances, or whatever other agents may be deemed productive of fever, cannot be admitted, nor even supposed, to produce their primary effects on any other parts of the living body than those to which they are immediately applied. Can it then be alleged, that the seat of the actual application of these agents is at all times extended over the whole of the system? Such a *supposition* is certainly *inadmissible*, not to characterize it by the epithet *absurd*. But even if they could be primarily applied to every portion of the body, still it appears probable, that there are only certain peculiar parts on which they are capable of originally producing their morbid effects. On parts defended by real cuticle in an unbroken state, it is strongly presumable, that neither miasma nor human contagion are able to operate, at least in their usual degrees of concentration and strength. Thus we know that variolous matter may be applied to the unchafed cuticle without giving origin to the slightest complaint. A similar observation may, in like manner, be often applied to matter discharged from a venereal chancre. At other times, however, such is the strength of this latter description of contagion, that it will produce its specific effects even through the unorganized cuticle itself. It appears to be a general truth, to which there exist few if any exceptions, that such descriptions of human contagion as are capable of giving birth to fever, *do not*, perhaps I may say *cannot*,

not, originally exert their pernicious influence on such parts as are defended by an unbroken cuticle. This reduces the sphere of their primary action on the system of man to a very narrow compass. The mouth appears to be the great port of admission for almost all febrile contagions into the human body. By the functions of respiration and deglutition, they are ultimately conveyed to the seats of their original action. Here they meet with parts readily susceptible of their operation and influence, because such parts are not defended by a membrane completely inorganic. On these they fix, and appear doubtless to be, in their earliest effects, locally confined to the spots of their actual application.

In the mouth, then, in the fauces, the pharynx, the larynx, the trachea, the lungs, the œsophagus, the stomach, or in some other part of the alimentary canal, must we search for the original nidus of most * contagious fevers. The contagious matter, whether inhaled during an act of inspiration, or taken in along with aliment or drink, attaches itself to one or more of the foregoing parts. On such parts it would appear to produce its earliest effects under the form of local disease. To the system at large these effects must

* The reader will observe that I have said the above mentioned parts appear to be the original seats of *most*, but perhaps not necessarily of *all*, contagious fevers. For I have indeed no hesitation in believing, that other contagions, besides that of the small-pox, may also become productive of fever, by being inserted beneath the cuticle by means of incision or puncture.

necessarily

necessarily be communicated through the medium of the laws of sympathy or association. Physicians do not call into question the existence of a general sympathetic fever, resulting from the derangement or suspension of the natural actions of a part in consequence of wounds, contusions, or the insertion of variolous matter in case of inoculation for the small-pox. Why then may they not in like manner admit, that a fever equally sympathetic may, and actually does, originate from an equal derangement or suspension of the natural and healthy action of some part of the primæ viæ, in consequence of the operation of a contagious poison? I must, for my own part confess, that I conceive a belief in the actual occurrence of such an event, to be founded on evidence equally respectable with that adduced in support of several positions, which are even honoured with the appellation of principles in medical science. Thus am I therefore disposed, from my present views on the subject of fever, to decide with Dr. Darwin in favour of its being a disease of association or sympathy.

IV. A fourth particular, of general import, in which Dr. Darwin and Dr. Rush appear to differ with respect to their views of *fever*, relates to the state of the *pulse* essential to the nature or constitution of that disease. Dr. Darwin, for example, would seem to consider a preternatural *frequency* of arterial pulsation as the only unequivocal criterion to discriminate fever from certain other diseases, to which the system of man is occasionally subjected. That this is
his

his belief, will appear evident from the face of the following clause, extracted from the Supplement to his work, containing an exposition of his theory of fever. "But as the *frequency* of the pulse," says the Doctor, "occurs both in the state of torpor, and in that of orgasm, of the heart and arteries; *this* constitutes a criterion to distinguish fever from other diseases, which are owing to the torpor of some parts of the system, as paresis, and hemicrania." Here our author is so explicit on the subject that, in my view, a mere citation of his words is alone sufficient to impress us with a conviction of his belief, that a preternatural *frequency* of pulse ought to be considered as the distinguishing phenomenon or characteristic of fever.

Very different, however, from that of Dr. Darwin appears to be the opinion of Dr. Rush on this particular point of physical inquiry. This latter medical philosopher evidently considers a preternatural frequency of arterial action, as nothing else than an occasional concomitant, or at best as a subordinate symptom of the febrile state of the system. An *irregularity* of action in the sanguiferous vessels, but more especially in the arteries, he holds to be the great criterion or characteristic of fever. The quotation of a single clause from the professor's Treatise on the Proximate Cause of Fever, will furnish the best illustration of his views on this subject.—"Fever," says he, "(when not misplaced) consists in morbid excitement and *irregular* action in the blood-vessels, more especially in the arteries.

arteries. This morbid excitement, or irregular action manifests itself to the fingers, when pressed upon the radial artery, by preternatural *slowless*, intermissions and depression in what are called inflammatory fevers, and by preternatural frequency without fulness or force, in what are called typhus fevers."

From the spirit of this passage it would appear, that Dr. Rush does not consider frequency of pulse as particularly characteristic of any description of fever, except what is usually denominated typhus by medical practitioners. It is an *irregularity* of arterial pulsation to which his views are principally directed. This he holds as a *conditio sine qua non* of the existence of fever; or rather he considers it as *fever itself*. Frequency of arterial action he alleges to be producible by other causes than that of real morbid excitement. Thus he observes, that excess of action often results from violence of exercise, and that frequency of pulse never fails to accompany fear, and other directly debilitating causes. Here, however, he declares the action to be still *regular*, and therefore very different from that *irregularity* of action producible only by morbid excitement, and which constitutes the proximate cause of fever.

Before dismissing this point of medical investigation, we would beg leave to observe, that the criterion for fever proposed by Dr. Darwin appears to be fallacious; while that by Dr. Rush deserves to be considered as much less exceptionable. Whether or not future discoveries in science may yet possess us of a febrile
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test more accurate and valuable than either, is an event, on the probability of which we presume not at present to determine.

V. The subject of *indirect debility* constitutes the last particular of a general nature, to which I shall solicit the attention of the reader, as giving rise to a diversity of opinion between Doctors Darwin and Rush. On this head my observations shall be neither numerous nor lengthy. Doctor Rush alleges that indirect debility, when induced in a certain way, affects the system by an accumulation of *excitability* equal to that which results from that description of debility denominated *direct*. “This increase of excitability,” observes the learned professor, “is said by Dr. Brown to be confined to a state of direct debility, but it takes place in all cases of *indirect* debility, where it is *suddenly* induced upon the system.”

On this curious point of pathology Dr. Darwin would appear to entertain a very different opinion. I do not indeed at present recollect, that he is in any one part of his writings particularly full and explicit on the subject. But from a general spirit which pervades the whole of them, it is evident, that he considers indirect debility as an exhaustion of one or more of the sensorial powers; and that the parts thus exhausted are not capable of being roused to subsequent action by the usual impression of stimuli, before these powers shall have been again restored by a temporary torpor or state of rest. Nor does the Doctor state any circumstance as constituting an exception to what

he considers, and advances, as a general truth. He does not intimate that there exists any difference in the result with respect to remaining excitability, between a state of exhaustion or indirect debility *suddenly* induced, and that which has been effected in a more gradual manner. In either case he would seem to presume on an equal expenditure of *sensorial* power, without the presence of which, no parts are capable of assuming the motions of life. The subject is doubtless an intricate one, and stands perhaps in need of farther observation and research, before any deduction relative to it can with propriety be reared to the dignity of a principle in science.

Having thus hastily traced a few differences in opinion between Dr. Darwin and Dr. Rush, in matters of general import in the theory of fever, I shall now take the liberty of giving a very brief statement of farther disagreement between the opinions of these two celebrated characters, in certain particulars of subordinate moment.

In his *ratio symptomatum*, or exposition of the theory of symptoms, Dr. Rush observes, that "local pains in the head, breast, and bones, in fever, appear to be the effects of the irregular determination of the blood to those parts, and to morbid action being thereby induced in them." Whereas Dr. Darwin would assign, as the cause of these pains, the existence of a *torpor*, and a consequent accumulation of *sensorial power* in the parts where such symptoms immediately occur.

The disposition to vomit, which often proves so troublesome in cases of fever, Dr Rush attributes to “morbid excitement in the vessels of the *stomach* ;” while Dr. Darwin would appear to deduce the same symptom from a torpor, giving birth to the retrograde movements of this organ.

Costiveness Dr. Rush considers as resulting from a “defect of excitement or natural action” in the bowels ; whereas Dr. Darwin alleges this symptom of disease to spring, at least in many instances, from an increased activity in the functions of the lymphatics and absorbents of the intestines. In consequence of this increased activity, the intestinal contents are robbed of the whole of their fluidity, and the residuum becomes too firm to be easily protruded forward by the peristaltic motions of the surrounding tube.

The dryness of the skin, which so uniformly occurs in most cases of fever, Dr. Rush supposes to depend simply on “diminished action in the vessels which terminate on the surface of the body.” This symptom is, however, explained by Dr. Darwin in a very different way. This ingenious philosopher does not appear to admit, nor even to suspect, a diminution of action in the secreting or exhaling vessels which terminate on the superficies of the body, particularly in cases where the skin retains its usual, or has acquired an increased, degree of temperature. Nor does he believe that there is a less quantity of perspirable matter discharged than in a healthy state. He even suspects the quantity to be considerably greater ; but
alleges,

alleges, that it is no sooner thrown out on the skin than it is again removed partly by the process of evaporation; but perhaps chiefly by the increased action of that branch or division of absorbent vessels which originate on the surface of the body. This explanation by Dr. Darwin is recommended to our notice by a considerable degree of speculative ingenuity; but it would seem to stand in need of certain experiments, and farther observations, before it can be considered as invested with the character of a well established physical truth.

High coloured urine arises, in the opinion of Dr. Rush, from an "*excess*," while that of a *pale* or lighter shade originates from "a deficiency, of excitement in the secretory vessels of the kidneys." These phenomena are accounted for by Dr. Darwin on principles entirely different. He supposes the *high* colour of urine to arise, in most cases, from the watery and pellucid parts of this fluid, being taken up in consequence of an excess of action in the *absorbents* of the bladder, while its paleness generally originates from a torpor or inactivity of the same vessels, whence the more watery portion of the urine is not taken up by absorption, but is suffered to be evacuated in a more pale or pellucid state. On this subject I would beg permission to observe, that a paleness of the urine does certainly not at all times indicate a deficiency of excitement and of action in the secretory vessels of the kidneys. As urine of this description is not unfrequently very profuse in quantity, are we not autho-

rised to believe, that under such circumstances, the secretory vessels of the kidneys are possessed of even more than their usual degrees of action?

Dr. Rush alleges the dryness of the tongue in fever to be occasioned by “an obstruction of secretion, and its dark and black colour, by a tendency to mortification.” The first of these symptoms Dr. Darwin supposes to proceed, in part, from an excessive absorption, and partly also from an increased evaporation, from the surface of the tongue, in consequence of the high temperature of the air which necessarily sweeps over this organ, as expelled from the lungs in successive acts of expiration. The colour of the tongue he supposes to be altered, for the most part, by the action of aliment or drink.

On the febrile phenomenon of *thirst*, it may not be amiss to submit to the reader the following remarks. This troublesome symptom, which Dr. Rush considers as “probably the effect of a preternatural excitement of the vessels of the fauces,” is explained by Dr. Darwin on a different principle. This latter physician seems to suppose thirst to be sometimes a disagreeable sensation succeeding to a torpor or temporary paralysis of the superficial or cuticular absorbents, in consequence of which they are incapable of taking up from the atmosphere a sufficient quantity of fluid for the purposes of the system. Somewhat similar to this is the opinion of Dr. Fordyce on the subject of thirst, as delivered in his Dissertation on Simple Fever. This author alleges, that the sensation of thirst may

may result, not only from an affection of the mouth and fauces, but also from a simple deficiency of water in the sanguiferous system. At other times he supposes that thirst may arise from the state of the stomach alone, independently of any affection of the mouth, or of any lack of aqueous fluid in the blood.

Having thus delivered a few comparative observations on the theories of fever presented to the public, by Doctors Darwin and Rush, I shall once more invite the reader's attention to an attempt of the latter physician to explain a certain febrile phenomenon, a knowledge of the cause of which he appears to have justly considered as an interesting desideratum in the science of medicine.

“ It only remains,” says the learned Professor, “ to explain the cause, why excess in the force, or frequency of the action, of the blood-vessels should succeed debility in a part, or in the whole of the body, and be connected for days and weeks with preternatural debility in the muscles, nerves, brain, and alimentary canal. I shall attempt the explanation of this phenomenon by directing the attention of the reader to the operations of nature in other parts of her works.”

“ 1. A calm,” continues the Doctor, “ may be considered as a state of debility in the atmosphere. It predisposes to a current of air. But is this current proportioned to the loss of the equilibrium of the air? By no means: It is excessive in its force, and tends thereby to destroy the works of both nature and art.”

“ 2. The

“ 2. The passions are given to man on purpose to aid the slow and uncertain operations of reason. But is their action always proportioned to the causes which excite them? An acute pneumonia, brought on by the trifling injury done to the system by the fatigue and heat of an evening spent in a dancing-assembly, is but a faint representation of the immense disproportion between a trifling affront, and that excess of passion which seeks for gratification in poison, assassination, or a duel. The same disproportion appears between cause and effect in public bodies. A hasty word, of no mischievous influence, has often produced convulsions, and even revolutions, in states and empires.”

The Doctor goes on still farther, to adduce additional instances of physical phenomena, in which there appears an equal disproportion between the magnitude of cause and effect. Nor does he propose any other facts, or attempt any other speculation than the simple adduction of such instances, for the explanation of the very intricate phenomenon to which his views were directed.

With all deference to Dr. Rush's authority as a professor, to his dignity as a philosopher, and to his learning and ingenuity as a man, I must conceive, that, in the present instance, he has fallen very far short of accomplishing the object which he held in contemplation. His aim was an explanation of a certain phenomenon intimately connected with the knowledge of fever. But I must confess I am not convinced

vinced that he has, on the present occasion, furnished us with any explanation at all. To me his observations appear calculated, not so much to explain as to confound. They teach us nothing except our own ignorance of what we would wish to know. Instead of explaining the interesting phenomenon to which they immediately relate, they discover to our view various other phenomena, equally curious and difficult of explanation. The Professor, it must be acknowledged, has here furnished us with certain lights, but, I am sorry to say, they are dim, green lights, of such a nature, as tend only to discover to us somewhat more of the extent of the circle of darkness by which we are unfortunately surrounded. Those unacquainted with Dr. Rush's love of truth, with his abhorrence of sophistical imposition, and with his active zeal for the discovery and establishment of just principles in medicine, might be led to believe, that in the present instance, his only wish was, to render his readers unmindful of one difficulty, by engaging their attention to the contemplation of others, equal, if not greater, in the science of physics. We find in his proposed explanation no regular chain of propositions, shedding each an additional gleam on the object of his research, and by their collective lustre tending finally to rescue it from that night of darkness in which it has been hitherto involved. Instead of this, we are presented with difficulty pressing on the rear of difficulty, as if the aggregate appearance of the whole, could in any way diminish the real magnitude of either.

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What though the wild tornado be a phenomenon disproportioned in magnitude to the deep tranquility of the atmosphere by which it was immediately preceded? What though the whirlwind of passion be even infinitely paramount to the trifling cause by which it was originally roused? or, What though there exist ten thousand other instances in which effects bear no shadow of proportion to the causes from which they originally sprang? Can a bare enumeration of these furnish a satisfactory solution to the proposition, “Why excess in the force or frequency of the action of the blood-vessels should succeed debility in a part, or in the whole of the body, and be connected for days and weeks with preternatural debility in the muscles, nerves, brain, and alimentary canal?”—Surely it never can.—Such an enumeration can produce no other effect than that of a deeper regret for the number of physical phenomena which, from our humiliating deficiency in science, we are unable to explain. Such an enumeration can only serve to bring within the sphere of our vision additional tracts of “*Terra incognita*,” without communicating to us the slightest information respecting the nature of the climate, the productions, or the soil.

Having thus endeavoured to show the insufficiency of Dr. Rush’s explanation, it may possibly, by some, be deemed incumbent on me to attempt one more just and satisfactory myself. This, however, is an office I must, at present, beg permission to decline. “The stripling scion cannot bear what bends the lordly oak.” Nor do I think it expedient to hazard myself in the

perils of an enterprize, where the difficulties are of such a nature as not to have yielded to the experience and abilities of Dr. Rush.

To conclude on the subject of fever. Dr. Rush has favoured the public with a theory of this disease, of which *simplicity* would appear to be the principal aim and characteristic. He has attempted, like most other systematic writers, to trace all febrile phenomena immediately up to an original *unity* of cause. That cause is, as already observed, nothing else than *disorder* existing exclusively in the *sanguiferous* system. The Doctor would seem to have taken little or no note of any thing amiss either in the absorbents or nerves. Perhaps in this respect his theory may not be altogether free from exception: But I presume not to decide with respect to a point of doctrine, on which perhaps some "shadows, clouds, and darkness still remain."

The theory of fever by Dr. Darwin is much more complicated, and considerably more difficult, to be thoroughly understood, than that which we have received from the pen of Dr. Rush. It would, however, be doing equal injustice to the author, and violence to my own feelings, not to declare, that to me it appears characterized by an uncommon degree of speculative ingenuity. Though by no means wholly original, yet, in two respects, it would seem at least to border on originality, and may be therefore considered, in the present instance, as worthy of particular specification. It represents fever as a disease of *association*, and furnishes

the most happy explication to many morbid phenomena by referring them to the action of the *absorbent system*. Not only in his Supplement on fever, but throughout his whole writings, particularly in his treatise on *Materia Medica*, Dr. Darwin seems to have, perhaps with much propriety, surpassed other physicians in his attention to this important system of vessels. By calling to his aid the well known action of the absorbents, he appears to have shed more light on the philosophy of several interesting symptoms of disease, than had been effected either by his predecessors or cotemporaries in science.

The Darwinian theory of fever will, no doubt, attract the attention of many physicians, and will probably receive a weighty and respectable advocacy. But whether or not it will be able to set at defiance the hydra-opposition of future times, and thus continue, "like the Newtonian Philosophy, a rock amid the waste of ages," is an event on the probability of which I am unwilling to pronounce. *Dies doceat.*

To the medical public some apology would seem necessary for the crude and indigested state, in which the preceding note on fever is presented to their attention. Its author flatters himself it may be sufficient for him to observe, that the thoughts and observations which it contains dropt hastily from his pen, and were most of them necessarily hurried into the press without having undergone even the shadow of correction. To

the "*limæ labor*" the reader will readily perceive they have not been subjected. Like the plaintive ghost of the murdered Hamlet, they were prematurely hastened to their account "with all their imperfections on their head." Distrustful of themselves, and conscious suppliants for special favour, they are anxious for an asylum, from the severity of justice, in the liberality and candour of the enlightened mind.

THE END.

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