A DISSERTATION

ON

THE INFLUENCE

OF

HEAT AND HUMIDITY:

WITH

PRACTICAL OBSERVATIONS

ON

The Inhalation

OF

IODINE, AND VARIOUS VAPOURS,

IN

CONSUMPTION, CATARRH, CROUP, ASTHMA,

AND

OTHER DISEASES.

BY

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"The Most High hath created medicines out of the earth, and a wise man will not abhor them."—*Ecclesiast.* xxxviii.

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Walter Channing M

Mch. 18, '56.

In Contents, page xii, for "thirst," read Thrush.
——— ——— xi, for "stones," read stoves.
In the Table, for "apsta," read apta.

THIS VOLUME

IS

DEDICATED

TO

THE MOST NOBLE

George Augustus

MARQUIS OF DONEGALL,

AS

A MARK OF GRATITUDE,

FOR

MANY FAVOURS

CONFERRED BY HIM AND HIS ESTEEMED FAMILY

ON

THE AUTHOR.

PRELIMINARY DISCOURSE.

THE dissertation, of which this is a translation, was presented last year to Dr. Alison, (Dean of the Edinburgh College,) for a medical degree. Owing to his lamented illness, a small part only was presented to the UNIVERSITY, the remainder being deposited, in Latin, with Dr. Hope. The imperfections, therefore, of this essay, are chargeable to the author's account alone.

The following pages embrace a great number of topics, because the influence of *heat* and *fluidity* extends to many objects. The author is totally unconnected with any bathing or other establishment. The censorious may therefore asperse, but they can point out no object for this production, except to aid the inquiries of the young medical aspirant, and to benefit our suffering fellow-creatures.

With regard to the MATTER of the book, it first glances at the influence of HEAT and DILUTION, on MEDICINE, next on DIET, and lastly, on the *Living Body itself.*

Whether the people of the County of *Antrim* incline to turn their attention to *Animal Heat,* from the warmness of their hearts, or the coldness of their climate, let theorists divine. Humbly following far behind* the admirable BLACK, descended from this place, and the most ingenious Crawford, a native of the neighbourhood, I offer, with great diffidence, a theory of the *principal sources of Animal Temperature,* calculated rather to elicit information, than to elucidate a subject so imperfectly understood. I am aware how far such hypotheses are beyond the reach of proof,—how much they are controverted by the peculiarities of cold blooded classes of animals,—and how anxiously they will be misrepresented by the colder blooded creatures around us.

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* Sequiturque patrem haud passibus æquis.—*Virg. Æn. 2d.*

The chapters on *Food* and *Drink*, intended for the young medical practitioner, and the general reader, it is hoped, may convey some useful remarks on temperance in living.

With regard to the designations given to the stages of inflammations, in the last part of this volume, they will alarm the fastidious. But is it not desirable that the student should investigate the *seat* of the disease, as well as its symptoms. If, therefore, we confer the *title* from the *residence*, the *name* from the local *habitation*, we convey the *meaning* of the disorder in its *denomination*. New terms are painful at first; but if the names of the muscles from their *origin* and *insertion*, and of neutral salts, from their alkalies and acids, convey *descriptive* explanations, so ought the nominations and classifications of diseases from the tissues they affect.

Hypotheses, though imperfect at first, may be productive of good in the end. Without preconceived notions, few would attend to long series of experiments. Induction is invaluable, but in general subjects of boundless extent its conclusions are too slow. Theories stimulate one side to confirm, another to refute; hence, many laborious investigations are instituted, which would not otherwise be undertaken. What Galen so elegantly expresses, is very applicable to this search after truth, we make our *manual* experiments, because they are suggested by *mental* conceptions.*

Respecting the INHALATION of IODINE, if I had not abundant proofs of its value, *I would not be the* FIRST to propose it. *It will sometimes heal, if early applied;* and it will give *rest*, and *repose*, and *relief*, in cases where it is *impossible* to cure.

But, unfortunately, in this place, the more good it contributes, the more it excites the systematic rancour which never slumbers, and the intolerant illiberality that has not slept.

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* "Ut autem sapientissimus animalium est homo, sic et manus sunt organa sapienti animali convenientia. Non enim quia manus habuit, propterea est sapientissimus, ut Anaxagoras dicebat; sed quia sapientissimus erat, propter hoc manus habuit, ut rectissime censuit Aristoteles. Non enim manus ipsæ hominem artes docerunt, sed ratio. Manus autem ipsæ sunt artium organum," etc.—Galen. de usu Part. l. i. c. 3.

One of the *little* band of brothers who shall soon be handed down to fame, deathless in the Dunciad,* lately interdicted a lady who was well, from soothing the sorrows of her fondest favourite, lest she should be exposed for a moment "to the *deleterious* vapour of Iodine," in an apartment where the patient and her family had inhaled it with advantage for five months!!!

The object of this remorseless persecution, would, as usual, *continue* to contemn it, if it only affected himself; but where it is industriously extended to the bed-side of the sick, alarming and separating the friends of the afflicted, then chastisement is charity; and recording the long and low intrigues of supercilious ignorance, and jealous mediocrity, is a duty which is due to society, and shall, in a short time, be abundantly discharged.

The honourable encouragement afforded by a great majority of medical practitioners to a man honestly endeavouring to improve his profession, shall also be detailed, as a contrast to the conduct of a despicable faction.

The happy versatility of some men is amazing, when the cant and sneering descriptions of "curing by steam," of "subjecting *patients* to the vapours," when solemn shakes of the head, alarming insinuations in whispers, and when damning with faint praise, do not answer their purpose, they then begin to think it necessary to know something about the matter they speak of, and declare that it may be tried in some *suitable* cases, but that the whole processes were well known in the days of Job, and that the apparatus and iodine were both exploded from practice when he died. More modern readers, who do not go so far back as the "*Man of Uz,*" affirm, that benefit may be in some rare instance derived from inhalation; but, that Dr. Mudge, with his tin tea-pot, and his pipe for the lips, is entitled to the whole merit of introducing the practice.

* The *Medical Dunciad* is preparing for publication (quarterly.) It is meant to do honour to the *many* to whom honour is due, and to afford to the public the benefit of the *private opinions* and conduct of the *few*. Authentic contributions will be gratefully received, to aid in conferring their merited immortality.

If space allowed us to compare great things with small, we could relate how Homer's enemies found all his "*ballads*" sold in the streets long before the flood. Harvey was plundered of his praise by the sharp-eyed readers, and mistaken interpreters of Fabricius ab Aquapendente. Jenner was snarled at, by some small barkers in Lincolnshire, because they had seen a few cow-pox on the fingers of their grandmothers. Davy was dunned with premature safety lamps, which had existed time immemorial, but which, by some mistake, had been applied to cure smoky chimnies. M'Adam, who has conferred a great advantage on his country, was anticipated by every description of ill applied and mismanaged broken rocks for roads. People who talk of steam engines, without knowing their principles of acting, wage war against Watt, and give all the merit of the discoveries to the Marquis of Worcester; because, when in jail, he amused himself turning little wheels by the force of the vapour issuing from the pipe of his tea-kettle. Dennis persecuted Pope with endless charges of plagiarism; and, until the new *Medical Dunciad* shall afford a remedy, we shall have abundant clamour, and noise, and uproar, claiming what they strove at first to ridicule, and vociferating with the improver of theatrical tempests, "*Thats my thunder!!!*"

Having alluded to the *matter*, I beg leave to say a few words respecting the *manner* of this work. It is hoped that indulgence will be extended by those who are aware how many avocations prevented that accuracy otherwise desirable. The greater part of the dissertation being turned from the Latin, without any attention to style, in the first manuscript, causes the language to be very different from what it should otherwise be. Redundancies also may appear in English, which might not be objectionable in Latin, where every word has its bearing and beauty; for the same reasons Latin quotations from the Classics, and other Roman authors, will seem pedantic in our language, which were very appropriate in the Latin Thesis.

In scienttific subjects, technical terms are unavoidable; but, in general, they are explained in the course of the discussions. In the *theoretical* parts, where no injurious consequences could result, general data are adduced with a latitude allowable in inaugural dissertations; but, in *practical* points, accuracy is as much as possible observed, and plainer language employed. Where the symptoms of diseases are detailed, they are described from nature, and taken from observation at the bed-side of the sick,—not from books.

If the numerous imperfections of this essay be overlooked, another volume may follow, written at once in English, and, of course, much more perfect than the present.

The circumstance of this being the first *medical* and *physiological* book ever published by any author in this place, cherishes a hope, that it shall not be altogether discouraged; particularly when the practical recommendations it contains, may be found useful to the general reader, as well as to the young medical inquirer.

The *hypotheses* regarding the sources of animal heat, are liable to numerous objections, which the author will gladly acknowledge, if offered in the liberal spirit of fair discussion, and love of truth. He is ready to relinquish his theories at any time for better. But the practice being founded on experience of nearly a quarter of a century, he trusts is rational and beneficial. The author has endeavoured to recommend the application and diffusion of heat, and humidity, and medicated inhalations, in an efficient and active manner, totally different in *time, quantity,* and *effects,* from the trifling methods hitherto adopted. They who know, that owing to repeated absence, and continued avocations, the proof sheets were sometimes printed off without proper correction, will excuse many minor inaccuracies, which might have been otherwise avoided.

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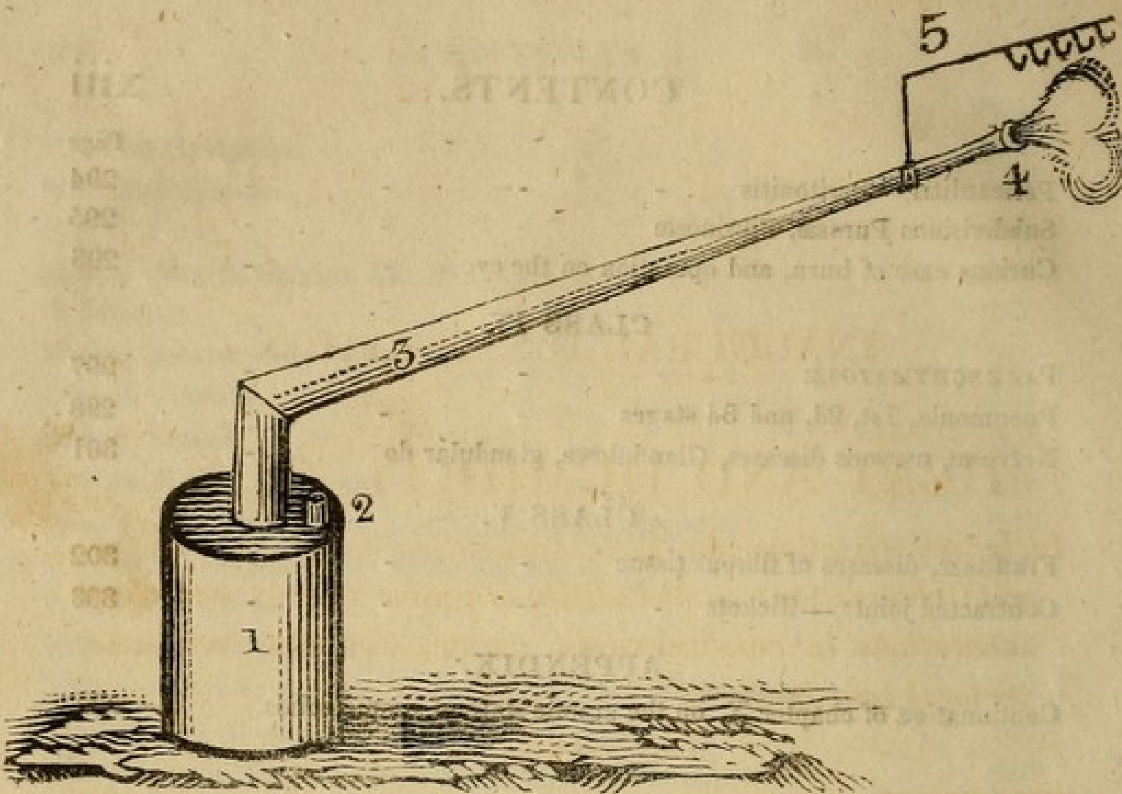
ERRATA.

Preliminary Discourse, page 7, for "naugural," read inaugural.
Page 18, for "*gypsum*," read *carbonate of lime*.
—— 40, — "gaol," read goal.
—— 54, — "mecurial," read mercurial.
—— 55, — "*dilate*," read dilute.
—— 62, — "injesta," read ingesta.
—— 90, — "Basis," read Bases.
——103, — "tera," read terra.
——138, dele "so little."
——141, Time in Bath, 30 minutes in place of 25.
——142, Vicinitatem, (Note.)
——158, for "permeable," read permeating.
——167, — "local," read locally.
——232, — "sternatatories," read sternutatories.
——257, — "the eye is flashing," read the eyes are gleaming.

[ENTERED AT STATIONERS' HALL.]



BOILER FOR VAPOUR.

FIG. 1.—A tinned iron vessel, holding four gallons of water. They are made larger or smaller, according to the dimensions of the apartment, and season of the year. They require to be replenished with water three times in twenty-four hours. Where it is desirable to preserve uniform temperature, boiling water can be used in refilling the vessel.

FIG. 2.—A large stopper for introducing the water; it is furnished with a hook, on which a small bag of Iodine, Hops, or any eligible substance, can be suspended in the steam.

FIG. 3.—If the vapour come over too rapidly, a wet cloth thrown round the pipe, condenses it.

FIG. 4.—The orifice where the steam escapes; it is best made with a screw, in order to adapt an additional pipe where the bed is distant. The opening is about $\frac{3}{8}$ of an inch in diameter.

FIG. 5.—A small slide, with hooks, on which a cup of Iodine, or any other medicine, may be suspended in the jet of hot vapour.

Here it may be remarked, that with a moderate fire, and heat of the room at 68°, a thermometer placed three inches from the orifice in the steam, arose to 178° in seven minutes; at six inches distance, to 148°; at nine inches, during seven minutes, to 120°; at one foot, during seven minutes, to 100°; at fourteen inches from the mouth of the pipe, the vapour can be easily inhaled, if requisite.

AN

INAUGURAL DISSERTATION

ON

HEAT AND HUMIDITY, &c. &c.

Including directions for their application in various diseases; with observations on the utility of IODINE VAPOUR, *and warm inhalations in* CONSUMPTIONS, CROUP, CATARRH, *and other pectoral complaints.*

THOUGH DILUTION and TEMPERATURE separately furnish ample fields for disquisition, yet I prefer speaking of them conjointly in this epitome. They exert such varied and mutual influences, producing reciprocal changes and modifications, that we will treat of their agencies under the following heads:—

1*st. The effects of* HEAT *and* FLUIDITY *on medicinal substances.*

2*d. The powers of dilution and temperature on* FOOD *and* DRINK.

3*d. Their influence on the* HUMAN BODY *itself.*

The subject of *temperature* induces us to venture a few *hypotheses* on the sources and diffusion of animal heat.

The first part of our subject, *the effects of heat and fluidity on medicines,* being very extensive, we will proceed to embrace a few of the most prominent features of this interesting department.

We may safely affirm, that the virtues and actions of medicines, from the three kingdoms of nature, are affected, by being exhibited in a fluid state, to a much greater degree than is generally contemplated. But as numerous other forms and modes of administering remedies were, and will always be resorted to, and as some of these are liable to various objections, we will glance, in the first place, at the most common manner of giving them in solid substance; and first, of

Vegetable Powders.

However sanctioned by time and experience, yet the exhibition of powders in general is objectionable. They have, in many cases, injured the patient, and disappointed the practitioner. Some substances are pulverized with great difficulty; some not reduced with sufficient care, so as to be impalpable: these abrade the internal surface of the stomach, irritate its nerves, interrupt digestion, cause a sense of scalding and oppression at the cardia, pass through the pylorus, and induce diarrhœa, and sometimes discharges of blood, with painful tormina and anxiety. In this way, bark (cinchona) and uva ursi, though both astringent, per se, induce diarrhœa, and injure the tender tissues of the bowels.

On the other hand, the finest powders may be rendered effete or hurtful, by the state of the primæ viæ at the time. If full of food or ill digested contents, a powder will become so covered and enveloped, as to be hidden until it is carried away, unacting and unacted upon Or it may be received into a viscus, loaded with thick viscid mucus, rendering it insensible to any effect from the powder at the part where it should act; and thus the medicine may be conducted to a more sensitive and distant place, where its potency may be too great and of course injurious.

Besides, if sensibility of the living fibre be too active at the time, or the irritability of the vessels or tunics too acute, their mechanical irritations may be as manifestly increased by powders, as opthalmia would be by dust blown into the eyes.

Here it may be observed, how much this delicate state of the primæ viæ is modified by changes of heat and cold, as well on the parts themselves as on the substances taken into them. Thus, if the feet be damp or cold, a medicine will disagree, that otherwise would do good. And at night, after exposure to air, exercise, &c. a substance will have an effect quite different from what it would produce in the morning, after a night's repose in a warm bed. A medicine, also, given in a tepid mixture, will act differently from what it will when administered in a cold one. Indeed, scarcely any agent changes the state of sensibility and susceptibility so frequently as the the alternations of temperature.

In cases of internal, or even external inflammation, I would look on the exhibition of powders as very objectionable; for even if the inflammation be not in the stomach or intestines, yet we know, that the sympathy and consent of parts influence one another like cause and effect. If any matter irritate the mucous membrane of the stomach, it will extend that uneasiness to those organs and surfaces with which it harmonizes. And vice versa, ailments of other organs, such as the head, liver, uterus, &c. will affect the stomach in such a manner as to render it unfit to receive or retain solid preparations, if irritating or gritty.

Further, we all know how much the functions of one individual are determined by certain modes of applications or remedies, differently from those of others. There are many instances of sensibility of the alimentary canal peculiar to some persons. In no department of our art is the study of such peculiarities so important as in this: when particular idiosyncrasies are averse to some tastes or odours, they are of less consequence to the physician, than when insuperable aversion is expressed against a particular remedy or form of medicine.

Many substances, when given in powder, produce consequences contrary to those desired. Camphor, if suspended in a vehicle, or even if it separate from a solvent in the stomach, so as to swim in the solid state, will cause great uneasiness, anxiety, and scalding, at the cardiac orifice; which excitement will prevent its sedative powers. The hard and gritty guiacum is, in like manner, determined from its object, and converted into a source of irritation, unless it be accurately mixed into an impalpable paste, with syrup, or some such fluid.

Powders are injured by keeping. Some by light, as digitalis, cicuta, savine, &c. From a fine green they soon become yellowish, if kept in glass. Others have such an affinity for moisture, that without the greatest care and attention they will soon absorb it from the air. Thus it is that squill powder, if long kept, or often exposed to air, in large bottles, will run into cakes, double the weight of the original powder, and will be otherwise deeply injured as to its qualities. Hence, one sample of powdered squill will act as a diuretic or expectorant, and another not.

Sometimes we see heavy powders, such as the carbonas ferri, mixed with light ones, as pulvis zingiberis. Greater care is, however, necessary in triturating and amalgamating these powders than is generally paid to them. The patient, disgusted at the mixture, in haste to swallow it, without syrup, or some proper vehicle, and uninformed how to rub it into a paste, suspends it in some thin fluid. The light powder swims, the heavy sinks, and is often partly lost.

I have several times known persons afflicted with severe salivation, from their attempting to wash down calomel, from a cup or spoon, by repeated additions of water.

Certain powders, such as lycopodium, will not mix, if thrown into a fluid; being, like feathers, endued with the power of repelling wet. You may dip your hand and arm in water, without, in the least, wetting them, provided the surface be sprinkled with the powder of lycopodium.

Hence light dry vegetable powders are badly administered in this state; and worse if mixed with heavy ones. For, besides the chemical changes sometimes occurring, as when bark and iron are mixed (making ink) the light and heavy powders do not well amalgamate, in the usual modes of mixing them; they are unsuitable to each other, and we should all join in separating them, "sine pondere, et habentia pondus," should be administered in better forms than in powders: but if these be still preferred, let each be given by itself.

Another objection to powders arises from the effects produced on them by the action of air during the progress of pulverization. Hence, Dr. Paris, and others, recommend that they should not be ground down impalpably. In his Pharmacologia, Dr. Paris says, (page 327, vol. I.) "The impalpable form seems to be extremely injurious to some bodies, as to cinchona, rhubarb, guiacum, and to certain aromatics; in consequence of an essential part of their substance being dissipated, or chemically changed during the operation."

What I have said respecting powders, is meant to apply to all those substances that are administered as such; and if coarse powders are at any time admissible internally, it is when it becomes advisable to deterge worms or viscid mucus from the primæ viæ. Powders may also be eligible, in some cases, as emetics. And we are aware, that coarse powders are easier retained in separated particles, and more extended in surface, when intended for decoctions, infusions, and tinctures.

What was said above, regarding the mechanical effects of coarse powder being advantageous in cases of viscid mucus, and consequent inactivity of bowels, is confirmed by observing, that coarse flour, or flour from which the bran has not been separated, when converted into bread becomes laxative, (in cases of torpor or overloaded mucous surface,) merely from its friction or excitement of the intestinal canal.

One reason why I would wish to diminish the number, or, at least, the commerce, in powders, is, to curtail the nefarious system of wholesale adulterations, which kill more than pestilence and the sword. As a proof of the extent of this cursed trade, it may be mentioned, that the *pulveres* can be bought for less than half the price of the root, wood, or bark, from which they are pretended to be produced; nay, in many instances, for one-fourth of the usual duty on the *genuine imported* article.

"Sunt quos curriculo pulverem olympicum,
Colligisse juvat."

With what feelings of agony and despair does the miserable mother look on the expiring torments of her beloved child, writhing in the tortures of excessive vomitings, produced and kept up by the fraudulent substitution of some vegetable powder, with tartar emetic, purchased by her, at a high price, in place of the milder and safer ipecacuanha, which she fondly hoped she had affectionately provided for her infant. I do not blame the pharmacopolist for these substitutes; but he knows that the system is a wholesale trade in London and elsewhere. When he wants a powder, he should have it pulverized under his own eye; if not, he will have a bad chance of success, or the approbation of his own conscience.

Fortunately, the late improvements in the extraction of the virtues of bark, and many other potent vegetable principles, in a small and tangible form—and the fact that most sedatives, diaphoretics, &c. are better given in pills, and any other forms, than powders, will aid in diminishing their number; and I hope yet to see the day when the dispenser and practitioner of medicine can truly exclaim, " *Ut palmam sini pulvere ferant.*"

In surgical pharmacy, the effect of fine powder is instantly distinguished from that of coarse. My valued friend, Dr. Joseph Burke, of the Rifle Brigade, will order the red precipitate to be rubbed in a mortar, with a few drops sps. vini, until it is fine and impalpable as the softest flour, then axungia to be added by constant rubbing, little and little, so as to produce a perfect ointment. This he will apply to soft, fungous, ill conditioned, inactive sores; and they will directly throw off their flabby membranous aspect, begin to discharge good matter, granulate, and look red and clean. This fine ointment will give no pain. Even the thick local ulcerations of the palpebræ of the eyes will be cured by it. The impalpable powder when applied, per se, soothes, whilst it cures. Other practitioners will order the red scales of the same nitrate to be mixed up with ointment, where they will shine like gems. Pain, torment, anxiety, and irritation, will be the result.

One will order the unguentum gallarum to be made up with the powder, *perfectly fine,* and will heal the relaxed and protruded piles. Another patient will obtain the ointment made up with the half ground fragments of the gall, which will only add to the inflammation and distress.

Notwithstanding all this, powders will continue to be kept, mixed, and given in all sorts of ways, ad infinitum. The accurate Dr. Paris says, that " the form of powder is, in many cases, the most efficient and eligible mode in which a medicinal substance can be exhibited."*

* Pharmacologia, Vol. I. page 326.

The weight of such authorities, with custom, interest, and sometimes convenience and choice, (as in cases of worms, and mucous viscidity of children,) will long continue the use of powders as a general form of medicines. It is, therefore, the duty of the practitioner and apothecary to take great pains to instruct the patient or the attendants, not by words alone, but by *actual manual demonstration*, how to mix the powders, gradatim; first, with a small portion of liquid, and to add more, by little and little, whilst mixing. In fact, they should be shown how to exhibit the medicine in the language of pharmacy, *secundum artem.*

Without this caution, the best physician, or the most careful pharmacopolist, may lose his labours and be disappointed by a nurse either too ignorant or too careless to pursue the *mechanical method* to be adopted in giving powders, both with regard to the *consistence* and mixture of the liquid used as a vehicle for administering the remedy.

They can all make mustard for the table, prepare starch, or infuse tea, on true scientific principles; but a beloved parent or friend may expire, for want of similar tact in the management of the intended remedy.

CAP. II.

Having so far spoken of vegetable powders, and the objections to which many of them are liable, I now proceed to venture a few remarks on the best method known to me of obviating those results.

It happens, fortunately, that in most instances such remedies as act on the bowels, as *purgatives;* on the kidneys, as *diuretics;* on the uterus, as *emmenagogues;* on the skin, as *diaphoretics;* on the lungs, as *expectorants;* and on the animal fibres, as *bitters* and tonics; are, in general, aided in all these indications, by dilution, and by a more minute division of their particles than can take place immediately when given in substance. It is fair, however, to premise, that as powders, though proper in other respects, may be partially lost, or produce bad effects, by maladministration, so every better mode of administering medicine may be injured by bad management,—the instrument may be rendered ineffectual by the mode of using it.

Decoctions, Infusions, &c.

We can truly affirm having seen various *powders* tried in vain, and *decoctions* of the same articles succeed in effecting a cure. It is certain, that these forms of medicine would be much more extensively employed, if proper modes of conducting their preparation were generally adopted, and scientific rules established for rendering the more fixed principles soluble without injury.

There is a prejudice against *decoctions*, from the idea, that, besides the active and useful powers, the water, in boiling, extracts other principles of plants, roots, &c. incompatible with the medicinal quality we desire to extract. It is well known, however, that if the hot water extract starch, tannin, gallic acid, &c. &c. along with the active ingredient we are in pursuit of, these very adjuncts may, and commonly do, aid, modify, and increase the value of the peculiar medicinal principle we are desirous to administer.

This prejudice, then, should no longer oppose, but rather encourage a more liberal use of *decoctions*, which can be made to present all the general qualities of herbs and plants to the surface of the mucous membranes, and to the lacteals, in a milder and a more minute state of division, than when exhibited in substance. In fact, it often happens, that any activity which a delicate or weak stomach may possess, is wasted in digesting and separating part of the solid remedy, long before any useful portion of its property can be eliminated or assimilated in the organs of digestion. A second objection to *decoctions* is, that many volatile, aromatic, and other useful properties and qualities, are dissipated and lost by the process of coction; and that extractive and other matters become liable to be oxidized and changed. Now, *infusions* are not liable to either objections: and, indeed, they attach more to the improper method of preparing *decoctions,* than to the decoctions themselves. For we are sorry to say, that badly as powders are prepared and administered in country towns, decoctions are still more improperly managed. A vessel without a lid, or with one fitting badly, is placed on the fire, and its contents exposed to the action of the air above, and the almost certainty of burning below.

This vessel is generally iron, its inner surface either not at all, or *badly* covered with tin. Cinchona, galls, oak bark, uva-ursi, and all astringents, by such a digester, are in part turned into ink; which, if not injurious, at least produces in the mind of the patient a disgust but too well calculated to render the medicine ineffectual.

Copper vessels are still more objectionable. Decoctions, in summer, become sour and dissolve the metal. Some ingredients contain natural acids, which are sure to act on it; and if the material to be decocted (such as cruciform plants) yield ammonia, the action on the copper is instantaneous.

A simple apparatus obviates all these results. Where a water furnace, or Balneum Mariæ, is not set in the laboratory, a common kitchen pot answers very well. A few metal rods may be placed across its mouth, on which proper jars or bottles may be suspended by hooks or a piece of wire. The bottles may have heavy ground stoppers, conically shaped, with the apex down. These, when the steam is strong enough to overcome their weight, by being forced up a little, will serve as safety valves, and prevent the bursting of the bottles. Corks with metallic springs will secure the jars.

Into any of these the ingredients are to be put; and to prevent the bad plan of taking them out after half boiling, and bruising them, as is done with Sarsaparilla, let the woods, roots, leaves, barks or seeds, be beaten into coarse powder, and then rubbed with some coarse powdered glass, (which process should also be observed in preparing tinctures, &c.): this keeps the particles separated, and greatly facilitates their agitation, and the solvent action of the menstruum. Let the necessary quantity be put into the bottle or jar proper to itself, nearly filled up with water, fitted with the moveable stopper, and suspended on the rod before-mentioned; the lower vessel, intended as a balneum mariæ, is then to be nearly filled with water, and made to boil.

The advantages of this method are:—

I. That many decoctions may be prepared at the same time; the ingredients prevented from collecting into a mass, by occasionally agitating the receptacle; and in this process the air does not enter.

II. The vessel does not injure the chemical quality of the liquor.

III. That the fluid will not contract a burned taste, nor the solid part incinerate, as in the common method, by adhesion to red hot iron. The common distiller, by proper machinery, agitates the contents of his still, lest these contents and the bottom of the still be both burned. The sand bath is nearly as objectionable as the naked fire. Its heat is uncertain, and often too intense.

IV. That the stoppers prevent the contact of oxygen; one decoction may be boiled only a few minutes; others as many hours; and thus the proper period for each be regulated, without any unnecessary expenditure of fuel, trouble, or time.

V. In this method of water-bath digestion, the products may possess all the desirable qualities of infusions, as the heat can be kept at any temperature the operator may desire. The water in the bath will keep boiling at 212°,* and the liquid suspended in it will remain at 207°. This would be the best mode to infuse tea. When we wish to make the fluid boil, if we add two pounds of sea salt to ten of water, the boiling point will be about 218°, and the material in the bottle will then boil. When the pressure or gravity of the decoction demands it, the balneum mariæ, saturated with sea salt, will rise to 225°.

Lastly, if desirable, we may, at a low temperature, draw off the infusion from aromatics, &c. At a high temperature, the more fixed qualities can be taken off, and both products may be mixed, if desired. Where substances require a *very high* temperature to solve them, or extract their virtues, linseed oil may be used, as its temperature may be raised so high as 600°. Water exposed to this heat would be converted to steam. *Air tight*, strong vessels, such as silver or platina, with screw stoppers, are here requisite. Such vessels in a bath of linseed oil, would digest *even* bone better and more safely than Papin's digester on the naked fire. Here the heat can be ascertained, and kept at any desired degree: nor is there any loss, as the oil usually requires such boiling for the uses to which it is converted. It is also likely that many resinous substances would more easily unite in the liquid form with alkalies, or oils, at a higher temperature than water can reach in open vessels.

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* Of Fahrenheit.

The desire of brevity prevents entering fully into the subject of Tinctures. But it is particularly to be remembered, that a substance having a strong epidermis, or being tough, as gum resins, should be rubbed *gradatim* with powdered glass, in a motar, together with the menstruum, and after being boiled a few minutes, kept in well closed vessels, in a warm place, care being taken to shake them frequently. If tinctures were not so frequently mixed with other medicines in prescriptions, it would be proper to have a set of *alkaline tinctures,* when the resins would certainly be better, and more freely dissolved.*

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* It is a curious property of linseed oil, that, when perfectly pure, we have congealed quicksilver in freezing mixtures in which the linseed oil remained fluid:—so that its range between the boiling and freezing point, is as great as that of mercury itself. As it might be a disideratum to painters and others, to know how to obtain linseed oil free from mucilage and extractive matter, I will mention the mode which we adopted for rendering linseed oil pure. A quantity of subacetate of lead was first rubbed with the oil, and well agitated in a close cask for some weeks; it was then allowed to remain at rest, when a thick, tough, white waxy sediment subsided, consisting mostly of gummy matter. The oil was then decanted or drawn off by a syphon; a solution of alum in water was then added to the oil in another vessel, and well shaken,—this soon subsided, and carried down a thick flocculent sediment, which floated between the oil and water, and appeared to be extractive. When the oil remained some time, it was decanted from this viscid substance, and in order to deprive the oil of any water, a little powder of burned alum was well shaken through it, which, falling to the bottom, abstracted all the water down to crystalize the alum, leaving the oil perfectly free from aqueous moisture. After this process the linseed oil is very pure, and becomes much more clear and transparent. We sent some of this oil to Mr. Warrington, a painter, in London, but have not yet heard whether it is improved for the purposes of fine painting or not. It remains to be proved whether the colours would not shine more bright through the clear and colourless oil, and probably be more permanent, being less likely to change than when containing mucilage, extractive, and other vegetable principles, liable to mutation and decomposition. Probably the Romans and other ancient painters had an oil less impregnated with vegetable extracts, than the common linseed oil which is now expressed, probably with more force and with a kind of percussion.

Rapeseed oil has been rendered, by the process here detailed, nearly as fine

Infusions.

LITTLE on this head need be said, after what has already been stated. From their preserving the aromatic qualities of the substances from which they are formed, infusions generally remain light and easy on the stomach, and become an agreeable cordial remedy.

Much might be written to show how many principles of vegetable matter water will hold in solution, in a state of combination, that, separately, are not soluble in that fluid. Thus Opium in a combined state, even in cold water, will yield its resin and other properties, which, if presented of themselves separately, would remain undissolved.

The apparatus mentioned for decoctions, is the best, also, for infusions, as one part can, if requisite, be drawn off at a low temperature, and the residuum be subjected to a higher. A minor heat, long continued, will generally prove more effective in these operations than a greater kept up for a limited time. Wedgewood's clay cakes contract as much by a low heat long maintained,

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as almond oil, and would probably answer well for machinery, when deprived of the glutinous matter it contains.

As linseed oil communicates so much heat to any substance boiled in a vessel set in it, and as all the degrees of heat can be accurately measured, which cannot be so well done in a naked fire or sand heat, this might be made a test or mode of distinguishing one thing from another, by observing the degree at which they separately volatalize or fuse.

Thus Sulphur melts at..........	234° of Fahrenheit,
Iodine,..................	210°
Camphor,................	303°
Tin,.....................	442°
Tin, 1 part and 4 lead melts at	460°
Bismuth,................	476°
White Arsenic sublimes....	283°
Metallic ditto,............	540°
Sulphuric acid boils	556°

The fusible metal, composed of 8 parts bismuth, 5 of lead, and 3 of tin, melts at a heat somewhat below that of boiling water.

as by a very intense heat applied but a short period. The jars or bottles already mentioned, may be left to cool, without admitting the air; and as much of the liquid may be made as will serve for each day's supply.

With respect to the diseases in which the milder form of infusions would be preferable to decoctions, and these again to powders, pills, tinctures, and electuaries, we may briefly observe, that, along with saline mixtures, they will be found highly eligible in fevers, inflammations, and all the pyrexiœ attended with great heat and urgent thirst. They are advisable in gravel and gout, and wherever dilution is essential as a curative part of the treatment. There are instances of polydipsia, in which they are the best form of medicine. Though dropsy and diabetes often require very active drastic purgatives, they can be well combined with decoctions and infusions.

In diseases accompanied with thirst, so intolerable that the desire to drink sometimes becomes irresistible, would it not be well, to prevent an indulgence in liquids injurious to the patient, by supplying him with suitably medicated infusions?

> "Crescit indulgens sibi dirus Hydrops,
> Nec sitim pellit nisi causa morbi
> Fugeret venis, et aquosus albo
> Corpore Languor."

Requisite brevity forbids dilating on the probable causes of thirst so urgent, in many cases of dropsy and diabetes, where the frame seems to abound in fluidity. Having made many experiments on the blood of such persons, I found it, contrary to expectation, in some cases, to abound in fibrine. The other elements, albumen, water, &c., having, in an undue proportion, passed away by urine, in diabetes—in dropsy, by the secreting membranes. Hence the great desire for liquors, that the fibrine being diluted, the red globules of blood might have their proper proportion of serum.*

This overproportion of fibrine in the blood is shown by the circumstance, that from such patients, when the blood is drawn off in a full stream, it exhibits a white concrete organized buffy coat, like thick skin; (see the case of D. Murray, in the Edin. Med. et Surg. Journal, for 1810;) for when dropsy supervenes from diseased kidneys, the urine coagulates, (as noticed by Dr. Price,) proving that the albumen of the blood abounds in that secretion. In like manner, in diabetes mellitus, the same elements escaping exhibit the basis of sugar, leaving azotic elements in the blood, in the more fixed fibrine. The partnership in the sanguineous components being thus broken up, some join principles incompatible with health—form new associations—pass away in the fluid secretions, leaving others deprived of due and healthy proportions and support.

In one case of diabetes, mentioned by me to my learned friend, Dr. M'Donnell, many years ago, the serum of the blood, when heated to about 170°, and evaporated, was washed with warm water; this water came through the filter quite sweet, showing that the elements of albumen, which pass so readily into those of sugar and starch, were undergoing that mutation long before reaching the kidneys.†

It is, perhaps, by abstracting a quantity of this fibrinous blood, that V. S. sometimes gives relief in diabetes, diminishing the thirst by lessening the necessity for dilution. At all events, it is plain that Dr. Rollo's practice diminishes the sacharine evolutions, but does not

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* Οὐδὲν γὰρ, φασί, ξηρότερον ὑδρωπικοῦ. *Longinus.*

† Vide Watt on Diabetes. This process was often repeated, but not with the same result.

permanently cure. It is probable, that when V. S. is admissible in dropsy, it does good by requiring a more active absorption to fill the empty veins, and thus dilute the fibrine with serum extracted from the exhaling cavities of the body. Infusions prove highly beneficial in many diseases, when given in large quantities and warm, by fomenting the bowels. (See Gregory's Conspectus, vol. II. pages 358 and 360, sec. 1427 and 1435.) Also, where their temperature may produce relaxation, in cases of stone, colic, strangury, and in inflammations of the neighbouring parts, for genial heat has great influence in tending to relax our bodies, and to resolve spasms.

In dyspepsia, where there is a nervous contraction, and also a creeping inflammatory state of the cardiac vessels much oftener than is suspected, copious warm infusions, and even warm water, impart benefit as well medicinally as by temperature, the large dilution greatly assisting. Hence, perhaps, the good effects produced at watering places. This is particularly the case, where atony and debility of the fibres of the stomach are present at the same time with irritability.

In the complaint which Doctor Crampton* describes as a peculiar disease of the mucous membranes of the intestines of children, fiuid remedies only can be judiciously employed. In these disorders the *villi* seemed converted into tubercles; in others were found pustular exulcerations, not unlike small-pox; in some there appeared a granular appearance of the villous coat, similar to that of dysenteric inflammation. A consideration of this circumstance points out how very injudicious would be the exhibition of powders, or any solid particles, capable of exciting, irritating, or inflaming the affected membranes.

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* Dublin Hospital Reports. See also Abernethy on the Pathology of the intestinal canal.

In general weakness, also, of the whole system, tonics, cordials, and invigorants, are best administered in the fluid state, and at the animal temperature. Where imbecility of parts, or of the whole prevail, mild forms of remedies are alone admissible.

> "Vacuis committere venis
> Nil, nisi lene decet."

I hope to be excused for dwelling on the necessity of paying particular attention to temperature, as well as dilution. I can affirm, that pain, disappointment, and even fatal effects have resulted from inattention to these particulars; effects "quœque ipse miserima vidi."

I dwell the more on solvents, and the powers of heat, because I have seen the potency of the one exerted against the other; either counteracting the nature and indications of the remedy, or obviating its energy, action, or use, on the living body.

> "Obstabant aliis aliud: quia corpore in uno
> Frigida pugnabant calidis, humentia, siccis,
> Mollia cum duris, sine pondere habentia pondus."

For the purpose of *decoctions*, *infusions*, and *resinous emulsions*, the water should be soft. Hard waters do not properly extract the principles of vegetables.

As it is not probable that the pharmaceutist will employ distilled water, he can easily render hard water fit for his purpose. If the hardness be owing to the presence of sulphate of lime, the addition of a solution of soda, twenty-four hours before making the decoction, will precipitate the carbonate of lime ~~gypsum~~, and the clear water may be decanted off for use. If the hardness depend on lime, or any other substance held in solution by fixed air, then boiling the water expels that air, and it becomes soft.

For all *decoctions* and *infusions*, the trituration of magnesia, along with the material to be infused, or decocted, greatly facilitates its solubility, and renders the water soft and sweet. If water have contracted any disagreeable flavour, agitating it with magnesia or charcoal instantly restores it to a state of purity. I have found that the saturated solution of bi-carbonate of magnesia is an elegant and useful solvent of camphor.

CAP. III.

De Medecinis Oleaceis.

CONNECTED with the solution of vegetable virtues in water, may be mentioned another kind of decoctions and infusions in OILS.

This vehicle of the active powers of vegetable medicine, is much used on the continent, but unmeritedly neglected in Great Britain.

Most acrid, narcotic and odorous herbs yield their medicinal qualities to oil, which, when macerated at a moderate heat, preserves them safe a very long time,—
"Nec casia liquidi corrumpitur usus olivi."

Most resins are thus soluble at a high heat, such as that of guiacum, though it is not dissolved by alkalies. Oil, therefore, affords a useful mode of exhibiting many remedies, both for external and internal use.

Pure Florence oil, obtained from the olive, is itself a mild laxative, and a good vermifuge; and hence it is the best medium for the exhibition of those medicines which expel worms, such as Scammony. Its local application, *per injectionem,* is also destructive to these animals in the rectum, particularly ascarides:—oil of turpentine carries off the obstinate and devouring tænia. Many persons evince a fondness for olive oil. And in cases of obstinately inactive bowels, they can take gamboge, colocynth, jalap, senna, &c., readily, and without danger of tormina, digested in oil. For those who are averse to this form, and prefer pills, an elegant soap may be formed, for this use, with any mild powder. Boil jalap, or any resinous purgative, in 61 drachms of oil, until it takes up what it can dissolve at a moderate heat. When digested, filter it off, and to the residuum add 8 drachms of soda and 31 drachms of water, mix and boil for a few minutes, then strain; mix the alkaline and oily fluids, and boil them with the addition of a small portion of muriate of soda into a soap.*

In similar chemical union, the gum resins can be given for pectoral or uterine complaints, and presented to the bowels in a much more soluble and divided state, than when administered in mechanical suspensions, in emulsions or mixtures. It should be observed, that as astringent vegetables decompose soap, they act better when digested with the oil alone.

Pure olive oil (probably from contiguous sympathy with the fauces and stomach), is an excellent adjuvant in

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* Mary Cole (Madame Kennedy's nurse) complained of severe pain in the side and abdomen. On examination I found a dull confused fullness and swelling in the hpyogastric region; this enlargement moved and felt painful on pressure. She had been under the care of a Surgeon-Apothecary of Belfast, during some months, who had ordered long continued courses of Epsom Salts, so as to keep up a discharge of watery evacuations several weeks.

Notwithstanding this long purging, I suspected that some solid fœces were still impacted in some duplicature of the colon, and immediately commenced the use of the jalap soap, combined with mercurial pill. As the severe uneasiness in the mass of swelling prevented repose, and kept up continual irritability and febrile anxiety, I ordered the opium soap to be well rubbed into the abdominal tumour, every night: the pain soon subsided: a week's perseverance with the new purgative began to bring away hard particles and fragments, which had evidently broken off from a larger mass, and in the end about two quarts of a substance like broken coals passed away, fixed in tough matter like clay. Instant and permanent health and appetite followed this treatment, as any person may see, who may choose to converse with this sensible and grateful woman.

irritable and teasing coughs, caused by dryness and acrimony of the bronchi; and, alone or with demulcents, has been an esteemed basis of cough medicines for tickling aridity of the top of the trachea, since the earliest times.*

Oil is preferable to alcoholic solvents in adminstering internal remedies to over-excited affections of mucous membranes in every part of the body, as the bladder, &c. It extracts all the virtues of savine, rue, melampodium, and such other substances as are thought to have a peculiar effect on the uterus, and is, therefore, a safe way of conveying their virtues to the desired use or purpose, so far as that object can be attained through the medium of the circulation.

In cases of stone, gravel, or other urinary diseases, oils form the best menstrua for the exhibition of such medicines as are intended to give ease and diminish irritation; such as wild carrot, parsley, &c. &c. In paucity of urine, attended with pain, oil conveys the virtues of the squill, in a bland and desirable combination; and in most of these cases its benefits have been greatly promoted, and its action facilitated, by previous softening of the surfaces by warm fomentation. I have been able to afford consider-

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* The case of Mr. Patrick Linn, formerly a respectable innkeeper in Belfast, may be adduced as confirmatory of this quality of oil. He was many years afflicted with such a hard, severe cough, that the sound appeared as if two swords were striking each other. Every demulcent, expectorant, and even the Iodine vapour, (to be afterwards mentioned) were tried with doubtful benefit. Finding that the cough was occasioned by aridity of the fauces and glottis, I ordered to him a mixture of four ounces of honey, intimately mixed and blended with twelve ounces of olive oil, of which a desert spoonful was taken when he found the tickling or dry sensation in his throat. This simple remedy continues to give constant and decided ease. Probably to the honey and inhalation some may attribute the credit of the relief, (for there is not a perfect cure;) but, provided good be effected, we are not apt to dispute about which is the best mode of doing it.

Utrum horum mavis accipe.

able relief to persons afflicted with chronic thickness, irritation, and consequent pains of the mucous membranes of the urinary organs, and also of the mucous coats of the intestines, where I had reason to think the small glands were inflamed, and semi-ulcerated, by giving freely decoctions of equal parts of *buchu leaves* and *uva-ursi*, in olive oil; and in chronic irritation of the rectum, which often brings on sympathetic urinary pains and heat, a decoction of three grains of opium in half a pint of olive oil, thrown up at 80° of Fahrenheit, never failed to relieve, *per injectionem;* and if a drachm of powdered galls be boiled with it, it is then an admirable remedy for piles, tumours, and membranous complaints of the rectum.

In excessive pains of the urinary organs, much ease has been obtained by rubbing the hypogastric region, perinæum, and parts around, for several hours, with hot oil, in which opium and poppy heads had been boiled. Warm cataplasms of poppy heads, chamomile flowers, and a few grains of opium, boiled into a pulp with oil and soap, never fail to give relief when applied to gouty and other pains in the joints. Similar fomentations relieve acute colic pains, those caused by the passing of gall stones, or concretions in the ducts, and nervous or spasmodic irritations.

Decoctions of opium in oil have also afforded more lasting relief per injectionem uterinam, in cases of ulcerated cancerous uterus, than what is given by watery decoctions or infusions of opium; probably because the oily applications, remaining longer on the ulcerations, mitigate the acrimony of the discharges; and if carcinoma be a congeries of animalculæ, as the celebrated Mr. Carmichael believes, then oil may have some specific effect against them, as it has against ascarides. An elegant liniment for inflamed and acrid soreness of the eyes, and to hinder the adhesion of the palpebræ, is composed of opium and oil, boiled and strained, with a few drops aqua potasæ, to give it a saponaceous consistence. A saturated soap, formed as above-mentioned from the seeds and leaves of belladonna and stramonium, when introduced on the bougie relaxes spasmodic strictures in the urethra, and this is aided by friction with the same about the pudenda. In fact, spasm in any part will be relaxed in some degree by constant friction with this potent combination. Doctor Dewees applied the extract of tobacco for the same purpose, in America, twenty years ago;* but we know that tobacco contracts the pupil, whereas both the substances here recommended, dilate it.

The high temperature which oils endure, may render them useful in extracting resinous fixed and nourishing qualities from bodies, whose organization cannot be affected at more moderate heats. But vegetables would be charred at a high temperature; and as most plants give out their virtues and even colouring matter to cold oil, a moderate heat is sufficient, and the oils are then less liable to become rancid. It is thus that the French prepare "Olea Medicata" from tobacco, cicuta, hyosciamus, stramonium, &c., by digesting one part of the substance in two of olive oil, at a gentle heat. Where the digestion of the stomach is weak, oily medicines are not eligible, as oil and fats are the least easily reduced along with food to homogeneous nourishment.

Liniments.

WHAT has been said of medicated oils, renders it needless to say much of liniments, except that external frictions, and exhibiting medicines by the absorbents, is not enough practised. Dr. Percival says, "liniments are very useful remedies, and it is to be lamented that ex-

* See London Medical and Physical Journal.

ternal applications of this kind are not more frequently employed, for there is reason to apprehend that powerful effects might be expected from them in various diseases."

Dr. Paris praises liniments in chronic affections of the viscera, as well on account of the friction to which they give occasion, as to the influence of that sympathy which depends on the proximity and contiguity of the parts, and which—as Sir Gilbert Blain states—the containing parts exert on the contained, as that of the integuments on the subjacent viscera. Under a burning sun, the natural moisture soon evaporates from the lips, and they are scorched; but if they be fomented with vapour, and then anointed with oil, or axunge, the epidermis is not burned. Medicated liniments will lubricate and soften the stiffening joints of the aged; but rigidity will come on by time, as the wearied system becomes worn by long use.

> " Fereus assiduo consumitur annulus usu,
> Interit assiduo vomer aduncus humo,
> Quid magis est saxo durum; quid mollius unda ?
> Dura tamen molli, saxa cavantur aqua."

It was not merely to lubricate the skin and emit agreeable odours, that the athletæ of old rubbed themselves with oil.

> " Exercent patrias oleo labente Palœstras,
> nudati socii—
> Nudatosque humeros oleo perfusa nitescit."

For, as Dr. Cullen says,* " friction may be diminished by emollients insinuated into the insterstices of dry particles, and thereby render the whole more flexible." The friction, therefore, of oil, would render the fibres and joints more capable of being elastic, and enable them to

* Materia Medica, vol. II. page 116.

bear the intense tensions and twistings to which they were liable in the struggles of the wrestlers.

There is another effect of oil alone, of which I speak with great diffidence, a series of experiments instituted on the subject not being yet finished or decided.

It has been long known, that in capital surgical operations, such as on cavities and joints, and those for Hernia, Cæsarian Section, Intus-Suception, &c., much of the danger resulted from exposing the internal membranes and tissues of the viscera to the contact of oxygen. That proportion of the danger or inflammation, which arises from this exposure, may be attributed, first, to the bad effects resulting from the action of the atmospheric air on the parts exposed, and on the blood contained in them.

Secondly,—To the impression and injury produced by a temperature, perhaps 30° or 40° below that to which they were accustomed.

Thirdly,—To the contact of the fingers, which, however delicately we handle the fine membranes, must injure the tissues, then excited and rendered sensitive by the disease, derangement, and exposure.

Fourthly,—To the evaporation of the natural moisture and lymph of the cavities and internal surfaces, which, escaping, leaves them harder and more parched.

Now, the indications for preventing these results would be, to exclude the air from acting on the viscera or exposed organs, to keep them at their usual temperature, and to take off or abate as much friction of the scaly epidermis of our fingers, and asperity of the instruments, as possible. To effect all these purposes, I see no mode so answerable as the use of oil,—mild and bland, plentifully applied, at *the temperature of the blood*, or, by way of fomentation, a little above it, that the new sensation of heat may divert the pain of the operation.

I was first led to this practice by observing, that a plumber cannot join or unite two pieces of lead together, if he allows the rasped and metallic surfaces to remain a moment exposed to the air, as the shining metal would directly become grey with oxygen. This oxidized coating hinders his joining material (solder) from adhering or amalgamating with the surface of the lead. To prevent this action of the air, so soon as he has produced a clear surface on the parts of the metals to be joined, he instantly applies tallow, lard, or oil, to the polished parts, and then he may leave the lead exposed to the air, until it suits him to go on with his operation.

"Fas est et a fabro doceri."

Reflecting on this and other similar consequences resulting from the exclusion of air, I opened several rabbits; an assistant pouring warm oil on the surface of the abdomen, previous to the first incision, and during the time of opening the peritonæum, and exposing and handling the bowels, taking care, on moving about the intestines, to keep them swimming in warm oil. Sometimes the bowels were taken out as far as the mesentery would permit, kept floating in oil for hours, and then reduced, and the integuments sowed up, still applying hot oil; for after the exclusion of the air, it was continued as a convenient fomentation to the abdomen and wound, to soften the surface and relax the integuments.

On one occasion the intestines were cut, and a piece of gut removed; the two ends were brought to the wound by a thread, in the mesentery;—this rabbit died. But, on the whole, (in these experiments,) comparing the cases in which the oil was used, with those in which it was not applied, its advantages were evident. The knife seemed to cut more smoothly, and probably with proportionably less pain. The asperity of the fingers was in some measure softened by the interposed oil serving as a varnish; and the only objection seemed to be, that the parts could be held less firmly, on account of their lubricated surfaces.

These experiments being connected with Temperature, one of the subjects under consideration, might be related at more length. But if the matter have merit, enough has been said to introduce it:—if it have not, then the less we say the better. The thing, I believe, is new, at least it is to me; but, "non nova dicere volo, sed *quid utile, quid non*."

Of Essential Oils.

My object having been to recommend the administration of remedies in solution rather than in substance, I need not say much of dissolving essential oils in water; but, if properly prepared, and in small quantities at a time, they are very convenient as essential waters, and more reasonable in price than the distilled. If the essential oil be well rubbed with dry magnesia, and the water added by little and little, during the rubbing, the particles of the oil will be so minutely divided and separated, as to be much more soluble in the water. On straining the mixture through paper, a very elegant essential water is obtained. Magnesia, for this purpose, is recommended by Dr. Paris.

Ointments.

It would be merging into the province of a compiler, to enter on the topic of this part of Surgical Pharmacy; but we may be excused if we adduce two instances of the influence of caloric in officinal preparations. Both were related to me by a most intelligent practical chemist, Mr. Duncan, of Edinburgh.

The first is the bad effects of moisture or water in preparing the ointment of the infusion of cantharides, which, owing to the water of the infusion, soon turns mouldy, however well we may endeavour to expel it by boiling. Mr. Duncan takes advantage of this curious circumstance, (another effect of heat)—that cantharides, if boiled, lose their property of inducing strangury, but retain their vesicating powers unimpaired. He, therefore, boils two pounds of cantharides at a time, and strains. The strained decoction he evaporates into an extract, and with this he makes issue ointment, permanent and good,—the cantharides are then dried, sifted, and made into very superior blistering ointment.

The powers of heat Mr. Duncan also applies to prepare the citrine ointment, so as to be superior to the golden ointment, sold so dear. He dissolves the quicksilver in the nitrous acid with boiling heat, and instantly throws it into the melted lard, also boiling hot; it swells to five times its former bounds, and, by making the mixture in a very large earthen vessel, prevents it from overflowing, by surrounding the vessel at intervals with cold water;—on mixing and cooling, a soft and elegant ointment remains; whereas, in our former methods, where cold was studiously chosen, a hard and friable ointment was the result. Mr. Duncan thinks that nitrous oxide gas is expelled by the heat; but it is more probable, that at the very high temperature at which he operates, the divellent nitric acid has the power to disarrange the ultimate elements which compose the stearin, and that they unite in cooling, in the proportions forming the eleaïn, and that hence is derived the fine oily softness of this valuable ointment.

Since this was written, I observe the accurate Dr. Duncan has introduced this ointment into his supplement to the Dispensatory, in the laudatory terms which it so well merits.

CAP. IV.

HOWEVER important the changes produced on the nature and action of VEGETABLES, by the influence of *dilution* and *temperature*, may be, they exert much more extensive chemical and physical mutations on the qualities, powers, and operations of MINERAL PRODUCTIONS.

In a medicinal point of view, this circumstance is more observable, and worthy of constant consideration in the exhibition of salts and saline substances.

A minute portion, or moderate dose of a neutral salt, taken in a large quantity of water, (particularly if that water be warm,) will empty the bowels, cool the system, relieve headach and irritability, and will increase the flow of perspiration and urine. On the other hand, a large quantity of the same saline aperient medicine, if dissolved only in a small proportion of water, will cause thirst, rigours, anxiety, nausea, and nervous spasms. The influence of temperature even exceeds that of dilution; and though taking place commonly in higher and lower alternations of heat than our system affords, yet when acted on by electrical and other causes of change in our frame, the agency of heat deserves the most careful attention. In the usual vicissitudes in nature many important revolutions are mutually produced. We observe how a concentrated solution of muriate of magnesia and sulphate of soda, change their elements at a high heat; the muriatic acid embracing the soda, forming muriate of soda, and the sulphuric acid taking the magnesia, making sulphate of magnesia; and, again, these two new salts dissolved together, will be decomposed in cold lower than the freezing point, at which a new exertion of the loves of the atoms will mutually produce a divellent attraction; a second time reproducing the original combinations.—

Large quantities of fluids assist in hindering the strong affections of the elements, and tend towards beneficial results, in exhibiting any of the products of alkalies and acids. Therefore, I think the administration of efflorescent salts in powder a very *objectionable* method of exhibition; many persons taking Glauber, or other bitter salts, desirous to make a draught which is so disagreeable, as small as possible, prepare a saturated solution in hot water, which they swallow in that concentrated state. Though the notion may be too extravagant, yet, as the circulation refuses to take in some salts, though imbibing the water which held them in solution, I have sometimes questioned whether it might not happen, that after part of the water was abstracted, the solution cooled down to the animal heat, it could run into a partial precipitate in the stomach. If this can at any time take place, owing to the condensed state of the solution and its contact with air, whilst swallowing, it would explain why we find the villous membrane sometimes tender, red, and abraded, after a dose so course, and account for the great heat and pain at the cardia, and the urgent thirst and desire of drinking which then prevails.

I have sometimes thought that nitrate of potass, and such salts, proved fatal as much by mechanical irritation, as by chemical or deleterious qualities. Nitre is soluble in one part of boiling water, but requires seven parts of cold water to retain it dissolved. When the solution of super acetate of lead is applied to the skin as a lotion, small crystals shoot so sharp and rough as to cause troublesome itching and excitement. Hence, that most accurate and indefatigable Physician, Dr. Duncan, recommends the use of the subacetate of lead only, in his ward at the Royal Infirmary. We ought, at all events, to administer saline solutions so largely diluted, that the villi of the primæ viæ shall suffer no injury; when they are irritated or excited, the skin, particularly of the face, suffers by sympathy or consent; in a similar manner, the head is shaken, as if with a convulsive spasm; the countenance twists andc ontracts, (vulgarly, grews;) the papillæ of the whole surface of the skin is felt as if erect and elevated; and the feeling also is, as if the membranes of the first passages were rough, rigid, hard, and nervous, through their entire convolutions.

The fact of the percolation of fluids with such rapidity, even when the pylorus and duodenum are tied,* would aid in accounting for the speedy exit of the watery part of these solutions from the stomach; at the same time we know, that when the salts are freely dissolved in the liquids of that organ, they are found in the kidneys of young persons in a few minutes after. This free passage of the saline matter, as well as the water which holds it, would rather show, however, that no separation or crystalization takes place. In fact, straining will not separate a salt from its solvent water, unless some chemical change takes place, and that change will be the less apt to happen, the more abundant the solvent water is. But the affinities of other constituents may take the liquor from the salt, for the membranous tissues are like the inorganic porosity of the skins of animals, they resist percolation, if dry; but, when moistened, fluids run through every membrane like a sponge.

The shoes we wear will resist wet when dry; but, if long saturated with moisture, then they are pervious conductors of humidity:—water is long resisted in its courses by many folds of the chamois leather; but when one fold after another is wet, then the water will be allowed to pass through in a stream. An infusion of galls taken into the stomach, will in a few minutes make ink

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* Magendie.

in the kidneys, and other parts of the abdomen, if touched with the solution of the sulphate of iron. The warm, living membranes are like saturated filters, transfusing a stream at the one side as fast as imbibed at the other; therefore, every vehicle of saline matters should be largely dissolved. See Gregory's Conspectus, page 358.

This transudation takes place through the skin, both inhaled and exhaled. Whether there be a system of vessels called exhalants, is not our business at present; but it appears to me that the arteries are quite sufficient for that purpose, as well as for depositing the nourishing matter of our blood; and if time had allowed me to prove by experiment, or the fear of theory not hindered, I might venture to say, from some trials, that the arteries exhale *inter dilitationem.* At the arterial diastole, the coats of the vessel are elongated,—the annuli, or rings, of the middle coat are separated in some degree by the distension; this coat is the only one not pervious in its matter, which resembles that of the brain, in colour, insensibility, structure, and chemical qualities; the other coats, being cellular, are permeable; when wet and warm, a few inches of the artery is distended at each injection of blood, and I see no reason to forbid the notion, that, during this distension and elongation, some of the aqueous or limpid part of the blood may be expelled through the arterial coats, the lymph passing between each ring of the middle coat; and that this limpid and colourless transfusion may be the nourishing part of the blood, before it is fixed and deposited, and also the vehicle of most other exhalations.

If we admit this much, then, as in our animal economy one mean contributes towards many ends, why cannot the same vessels, during their systole, and in the act of contraction, absorb, or take up some fluid elements, or altered constituents, which may be at that moment presented? But there is little need to entertain this latter notion, seeing that we have a *system of absorbents*, and a greedy series of voracious veins;—one thing, however, is very plain, that no colouring part of the blood is laid down as nourishment, or pabulum, and that what feeds our bodies, bones, and tissues, is transparent and colourless, and very probably laid down, not by open mouths, but in some such manner as is here shown.

Mascagni maintained the transmission of watery exudation; and it is easy to conceive, that when the artery contracts and stretches, it presses out the lymph transfused to every organ and membrane, the capillary artery, in the meantime, being prolonged into the minute vein: hence, it is more reasonable to believe, that nourishment is poured out at every part of its course, by the curiously constructed artery, than at exhalant orifices, such as Boerhave fancied, and Bichat taught. It is plain, that the more minute the terminating arteries become, before passing into the incipient veins, the more thin and permeable is the structure of their coats, and the more fine and limpid their contents, and, of course, the readier their escape to moisten, nourish, and renew the places where the fluid is transfused. If we admit the transudation between the rings, we may advance further than the avowal of Cruikshank,—"that we are unable to prove satisfactorily the existence of any set of vessels, or any mechanism by which it (transudation) might be accomplished." Whilst hinting at the probable mechanism of exhalation, not through the dense, impervious matter of the middle coat, but between its annular rings, passing through the cellular tela which connects them, I can show, by experiment, that if you distend an artery with thin liquor, and stretch it out, so as to push the rings by longitudinal distension, as if separating them to a greater distance by elongation, the fine injection runs out freely. Is it on this principle that blood issues from the bronchial membrane, without breach or laceration? or is it thus that the more copious discharge of pulmonary apoplexy takes place?—and is it thus that a menstrual tension, and longitudinal extension of the uterine vessels bedew the inner orifice with blood? We know that periodical terms produce periodical enlargements, and consequent distension of these parts.* Portal, Abernethy, and Bichat, have shown that, in hemorrhage, from the gastro-intestinal membrane, at any point, the blood oozes out without gangrene, or breach of vascular surface or organization: the same is the case in dysentery, hemorrhoids, &c. The blood which flows off by urine, is (unless caused by the attrition of stone,) exhaled from the vessels without rupture; if it exhaled from open pores, these pores, permeable to red globules, would be large enough to be seen; if it bedews the surface by transfusion between the annuli, then no open or lateral pores are required for this purpose.

There are many tumours composed entirely of blood; there are many others, which, I have reason to think, originated in one or more clots, and that their sacs or cysts first formed as membranes in the same way the buffy coat does, and extended when organized and vital; and in all cases of these, no rupture of the arteries of the part could be found. The writings of Severinus, Frank, Scarpa, Montini, Monteggia, &c. &c. relate to the contents of these tumours, but do not explain how formed: they are also described by Hooper, Monro, &c. The varieties of these tumours must depend much on the greater or smaller deposition of albumen, gluten, serum, fibrine, and osmazome, from the blood itself.

This digression concerning percolation, exudation, and secretion, unexpectedly arose from the connexion of

* See Dr. Craigie's valuable work on Physiology.

temperature and copious dilution, with the perspiration and other exhalations, which they so extensively regulate and promote; and are adduced partly to explain some of the modifications of heat in the exhibition and application of vapours, and their effects on the animal tissues, a topic of unbounded importance, to which we will direct attention when we come to the third division of this paper,—viz.: the action of temperature and dilution on the living body itself.

The dilution of many products of the earth, such as iron, magnesia, lime, &c., was usefully furnished to mankind by nature herself. One thing is admitted, that we owe the medicinal benefits of mineral waters principally to their quantity, temperature, and diluting effects, in communicating the virtues they derive from the substances they hold dissolved. There is no form in which iron irritates less than when exhibited in the state of the proto-carbonate, and this is best effected by administering it dissolved in water, by means of carbonic acid; for when in the state of powder, it soon passes into the percarbonate, and then it excites, irritates, and brings on rawness and pain of the cardia. Lime, also, is better exhibited in the state of the solution of the bi-carbonate, than, as is usual, giving the caustic lime water. The solution of quicklime, if it meets fixed air in the stomach, is soon converted into a carbonate; if not, its causticity abrades the mucus, for which it has such affinity. With regard to magnesia, I observed, twenty years ago, when attending a child named O'Neill, in conjunction with a respectable surgeon (Mr. M'Cluney,) residing in Belfast, that when calcined magnesia, or mixtures containing it were given, it soon caused great tormina, or colic pains, and in some time passed off enveloped in mucus, composing hard lumps like peas. I soon found that the same effects took place with many other patients; that where the magnesia met with acid sufficient only to dissolve a small part of the earth, the remainder lay in some folds of the bowels, or in the caput cœcum, or passed away in granulous concretions.*

These observations led me to recommend its being dissolved by excess of fixed air, under powerful pressure. This served several useful purposes, particulary the separation of the magnesia from *gypsum* and *silica*. This solution had the valuable property of neutralizing acids, and allowing the remainder to pass away in the liquid state. The great expense of safe vessels, and sufficient pressing apparatus, with the encouragement of Drs. Hope, Cleghorn, Gregory, Barker, and many other eminent names, induced me to bring it more before the public than I at first intended. I have as far as possible endeavoured to explain its nature openly and candidly, because, any concealed medicine deserves not the countenance or support of the faculty. When the composition is properly set forth, then fair judgment can be formed of its value, and the article stands or falls by its own merits.

The fluid bi-carbonate of magnesia is a fine vehicle for camphor, which it dissolves; also, for mixing with bitter or aromatic infusions, and in cases of constipation, for the conjunction of any convenient aperient neutral salt.

By increasing the pressure to many atmospheres, a solution of bi-carbonate is formed, giving a sufficient dose of the antacid medicine, dissolved in an ounce of water.

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* Mr. Brand, in the *Phil. Transactions,* and several others, have many years since confirmed this fact, which I first pointed out. Concretions of solid magnesian hydrate have been found in the intestines, weighing several pounds.

PART II. CAP. V.

THE INFLUENCE OF TEMPERATURE AND DILUTION ON ALIMENT AND DIGESTION.

HAVING hitherto briefly and imperfectly glanced at the first part of the subject proposed to ourselves, namely, the INFLUENCE OF TEMPERATURE AND DILUTION on Medicinal Substances, we come next to venture a few remarks on the same agents, as affecting articles of nourishment, FOOD and DRINK. If a regular treatise were attempted on these heads, the consideration of *aliment* should precede that of *medicines*; but in this little dissertation, where only a few observations are offered regarding digestion and nutrition, these outlines are adduced in this place, being in some measure preliminary to the third division of our paper on the agency of heat and moisture on the body itself. We may therefore quote the words of Sallust, in excuse for deviating from the point of priority, which was certainly due to the subject to be discussed in this chapter:

"Tempore posterius, re atque usu prius."

The numerous and invaluable works already extant on Dietetics, render it quite superfluous to descant at any length on those topics. My object is not compilation, but to speak of the action of increased temperature and minute division on those substances taken as sustenance and support to the animal frame. When we reflect that the stomach is as it were the principal part of a chemical apparatus, aided in its operations by auxiliary pipes, strainers, solvent liquors, and warm contact of soft surrounding organs, it will be granted, that, under all these circumstances, the potency of this laboratory is great and important. The power exerted on the substances taken into the stomach, is materially modified and increased by the due admixture of diluents, which, in proper proportions, tend very considerably towards effecting that solution of alimentary matter and subdivision of its particles determining towards chylification.

Though digestibility is different from solubility, yet perfect solution is a proof of the food being reduced to a condition adapted to nutrition. The more aqueous constitution of vegetable organized matter, renders it in general more easily decomposed and changed in the process of ordinary digestion, when properly prepared for that purpose.

From the days of Hippocrates to those of Galen, and since his time till that of the elder Cheyne, and more lately of Duncan, Lamb, and Paris, abundant proofs have been adduced of the importance of attending to the value of a regular portion of vegetable ingesta, in regulating the process of nutrition. This preference, given to a larger proportion of vegetable aliment, is proved to be well founded, from being the only regimen admissible in a great variety of diseases, in which relaxing and diluting food can only, with propriety, be used.

This is fully evinced in considering the regimen adapted to patients in all acute diseases,—active hemorrhagies, the first stage of phthisis, in acute rheumatism, and gout, in dropsy of the inflammatory kind, and in most severe local and cutaneous disorders, softening and bland vegetable nutriment is alone safe, and for it only does nature give the sufferer any relish or desire. More lately the value of this species of support has been farther enhanced by observing, that even syphilis, in several of its varieties, and many obstinate affections of the skin, yield to *vegetable food*, warm drinks, and repose in comfortable beds, and this without the use of any medicines whatever. These facts furnish undeniable proofs of the importance of strictly adopting and continuing such modes of living as dispose the system to resume and preserve a new and improved condition, incompatible with disorder, and adapted to maintain a regular discharge of the animal functions in a healthy and perfect state. The animals subsisting on esculent grasses, roots, and leaves, long enjoy almost uniform general health, and are exempt from obstructions and febrile affections: on the other hand, the most careless observer must perceive the injurious effects of solid and concentrated provender, such as is dry and hard, and without a due proportion of aqueous admixtures, and soft vegetable matter. Such condensed fare has been stated by the ablest veterinary practitioners to be the cause of vertigo, blindness, staggers, and other diseases of the horse.

Dr. Cocchi, an eminent physician at Florence, wrote an excellent work "on the regimen of Pythagorus," in which the doctrine of the Pythagorean diet of vegetables is reconciled to the mind of every candid reader, as being eminently conducive to maintain tranquillity and serenity of mind, with perfect and uniform sanity of body.

"*Dicite quam parvo liceat producere vitam.*"

Fasting and abstinence indirectly confer all the benefits which light food and dilution can afford after excesses. If crudities, or over repletion of solid ingesta, oppress the organs, or impede their offices, abstemiousness gives time for the secretions to soften, dissolve, and carry off the peccant, unconcocted substances. In the interim, an opportunity is afforded to the containing parts to recover their natural tone, after the expulsion of the contained. By a considerable abstinence from solid food, the rest and quiescent relaxation of the tunics and fibres of the alimentary cavities greatly conduce towards rendering their functions refreshed and repaired. When an animal is kept long fasting, the lymph contains colouring matter of the blood, or red liquor,* owing to the increased and more active absorption then going on to fill the comparatively empty veins. It is needless to enlarge on the importance of this fact to the medical treatment of many infirmities attended with swellings, obesity, and languid absorption. Whoever has been curious enough to read the lives of very old persons, eminent for sanctity and temperance, will find the balance of good health and long life greatly in favour of the abstemious. Even in warm climates, where human life runs sooner to its gaol, the longevity of the austere faster astonishes, whilst it convinces us of its salubrious influence. The following may be instanced from among thousands of similar examples of the prolongation of human life :—St. Paul, the first hermit, lived 113 years; St. Anthony, 105; Sts. Euthymius, the two Macariuses, Paphnutius, Sabas, John of Egypt, John the silent, Theodosius the abbot, James of Persia, all enjoyed sound and vigorous health each about a century. St. Arsenius lived 120 years: Josephus tells us that the Essenes were remarkable for living long, many to the age of 100 years, by the plainness and moderation of their diet, which was only bread and some kind of gruel or pap.†

F. Leonard Lessius, who died at Louvain, in 1623, and wrote a book, "*De Valetudine tuenda,*" instances

* Sir E. Home. Phil. Trans. 1811.

† Longevity.—See a valuable article on long life, in Ree's Encyclopedia.

his own perfect recovery, in his youth, from dangerous illness, by abstemiousness alone, and relates his tranquillity and healthiness, during nearly sixty-nine years. He translated, into latin, the work of Lewis Cornaro, on temperance; and as the case of that nobleman is alluded to by Thuanas, Hist. I. 68., and by Justiniani and Bembi. Hist. Venet., and being both useful and instructive, I hope to be excused, if I endeavour to make it more generally known to my young readers. Though I should be sorry to find my friends limiting their food to twelve ounces per day, yet this case being so much recommended by Addison, in the Spectator, I am induced to quote it at length, as an example of the value and importance of punctual regularity to the regimen of invalids. "Lewis Cornaro, a nobleman of Venice, a person of great abilities and learning, at thirty-five years of age, found himself reduced by intemperance to such a state of health, under a complication of diseases, and pains in his stomach, and often in his sides, with a continual fever and thirst, that he tried all manner of remedies, and consulted all the ablest physicians during the space of five years, without finding the least relief. At forty, when the physicians despaired of his life, he resolved to try what abstemiousness would effect. By experience, he found the falsehood of that common proverb of gluttons, 'that whatever is savoury to the palate is good and nourishes:' for strong and cool wines, melons, raw lettuce, fish, pork, sausages, cake, pye-crust, and the like, pleased most his depraved appetite, yet were most hurtful to his constitution. These things, therefore, he shunned, and used only such as agreed best with his constitution, and in so moderate a quantity, as always to leave off eating with an appetite. Thus he soon brought himself to take only twelve ounces of food in a day; by which he was so perfectly freed from all his complaints, in a manner which seemed to his physicians almost a miracle. By continuing this sober life, he enjoyed a state of perfect vigour and health. Through extreme vexation which he sustained from some others, and a troublesome lawsuit, attended with many most disagreeable circumstances, some of his friends were so overpowered by melancholy as to fall into diseases which cost them their lives; but he who was the principal sufferer, felt no inconvenience in his health from these disasters, which he ascribes to the sound temperament of his body, free from those humours which melancholy or trouble could vitiate. When he was seventy years old, by the overturning of his chariot, his head and whole body were much hurt, and one of his arms and legs put out of joint. The physicians declared that at his age he could not live three days, and were for purging and bleeding him. He would not allow either, alleging that his temperate manner of life rendered those remedies unnecessary, but ordered his arm and leg to be set, and his whole body anointed with oil; and he perfectly recovered without any other remedy. So true did he find the two Italian proverbs: 'He shall eat much, who eats little at a time.' Mangere piu, chi mancho mangia. And 'The meat which is left on the plate, profits more than that which is eaten." Fa piu pro guel che si lascia sul tondo, che guel, che si mette nel ventre. Cornaro, in his 75th year, suffered himself to be so far overcome by the importunity of his friends, on pretence of his old age, as to add two ounces to the quantity of his daily food, which he increased to fourteen ounces exactly, weighed, of bread, and eggs, or flesh and broth, and two ounces to his drink, which from fourteen he made sixteen. This addition made a great alteration in his constitution and health. In ten days, though before cheerful and merry, he became melancholy, and troublesome to himself and others. On the twelfth day, he was seized with a pain in his side; and, two days after, with a fever which held him thirty-five days; and he was only cured by abstemiousness; after which he returned to his former rule of twelve ounces of meat, and fourteen of drink. By this means he testifies, in his 83d year, that he lived always free from any trouble of mind, or bodily pain. At that age he easily got on horseback without any advantage of the ground, went up high stairs and hills, was always cheerful and merry, enjoyed the conversation of witty and learned men, and read and studied much, living sometimes at Padua, where he had a great and elegant house and gardens; and sometimes at some of his country seats, employing his hours of amusement in architecture, painting, music, husbandry, draining marshy lands, erecting churches to God, and drawing men together to worship him in them. In his 83d year, he composed a spirited comedy, full of youthful fire and wit; and at the same time wrote a treatise on Temperance, in which he gives this account of himself. He had then eleven grand-children, all in perfect health, children of the same father and mother. He always slept well, retained his vigour and intellectual faculties to the last; passed his old age without any complaint or sickness, till that of which he died, at Padua, in 1565, which was short, and seemed without pain. His death was so easy, and he received it with such cheerfulness, being upwards of one hundred years old, that it was truly a pleasant passage to immortality."

Cassian, lib. 5, de Gastrimargia, c. 14 and 17, eloquently confirms the statement advanced by Lessius, in which he shows that Temperance is the mother of good health, prevents the overfulness of humours, and of a bad digestion, crudities, and all distempers which flow from these causes; makes bruises and outward accidents less dangerous to the body, mitigates incurable disorders, makes death easy, abates the passions, preserves the senses of the body entire, and, much more, the vigour of the understanding and memory, and is the ground and basis of virtue.

The following observations by Alban Butler, who had more opportunities of judging well of the subject than most men, is quoted, because his condensed statement accords so well with the writings of those who treated of diet, as Junker, Arbuthnot, Hecquet, Cheyne, Lemery, and Lorry, *Sur les Aliments,* Tissot, and those who have since enriched the department of dietetics with their valued observations. "Its practice is attended with difficulty in the beginning, in overcoming the habit of intemperance; but this being mastered, it is productive of much delight, and incomparable advantages. Health is not only preserved by it, so as seldom to stand in need of a physician, but most distempers, especially those which arise from repletion, are cured by fasting, which is the most easy and natural means of disburdening nature, that she may be enabled to exert her powers in her own relief. For nature alone is able to repair her decays, and restore her functions; physic can only remove obstacles which impede the vigorous exertion of her powers in her cure. Usually, a fast of one or two days has the full effect of a course of physic, and does its work in a much safer and more effectual manner. Many persons within the circle of my acquaintance, chiefly those who led the most exactly regular lives in religious convents, have attained to a very advanced old age, without having ever made use of any apothecary's drugs, or consulted any physician, having made it their rule, whenever they found themselves indisposed, to fast one, two, or three days, till they found their health re-established. If austerities have ever hurt any one's constitution, it must have been owing to an extreme excess, or to some particular circumstances, as unwholesome food, too sudden a change in the manner of life, dampness, (always contrary to the good state of a human body,) a neglect of precautions in passing suddenly from heat to cold, &c. It is in the most austere regular institutes of religious men that we shall most frequently meet with persons blessed with a vigorous and sprightly old age. Such was the austerity practised by the ancient hermits of Egypt and Palestine. Some confined themselves to a small quantity of fruits, herbs, or pulse, others to bread alone."

Cassian, inst. c. xix. 21, &c., says that fasting is the most general cure of the more common and fatal distempers, and that strict abstemiousness and temperance is the mother of health, and main support of long life, as is proved by the experience of all physicians. Mr. Butler states:—" It is, however, carefully to be observed, that changes in the manner of a person's living must be made gradually, and not on a sudden. For plentiful meals enlarge habitually the ventricle, which long habits of temperance contract, in which any great change made at once is dangerous. Neither is it prudent in those who have lived plentifully, and are exposed to deviate sometimes from their rule, by living in the world, to confine themselves totally to vegetables, or any one kind of diet, as Dr. Arbuthnot remarks, against the rigorous prescriptions of Dr. Cheyne."

The coincidence of opinions respecting temperance, abstracted from religious institutions or customs, is striking and undeniable, since the earliest times. Plato lived to the age of eighty-one. Pliny gives us a list of temperate persons, remarkable for health and long life. Plott's history of Oxfordshire contains many instances of very old persons, who lived on simple vegetable fare. Doctor Harvey's account makes Old Parr, of Shropshire, 152 years and 9 months; and Dr. Tancred Robinson stated the age of Henry Jenkins, of Yorkshire, to be 169 years. (See Lowthorp's adridg. Phil. Trans. vol. iii. page 306.) The learned Hakewill, Apol. p. 181., sets forth the following reasons for the brevity of life in some, and the length of it in others, of which he gives numerous examples. The shortness of life he attributes to "too tender education, sucking strange nurses, too hasty marriages; but, above all, to luxury, high sauces, strong liquors, &c." The longevity of the ancients he ascribes "to temperance in meat and drink, anointing the body, the use of saffron and honey, warm clothes, fewer and smaller doors and windows, *less physic* and *more exercise*."

> "Est virtus, placitis abstinuisse bonis."
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> *Ovid. Epist.* 17, 98.

However uniform the sanity of body and mind, and however long the life of those whose food consisted of "herbs and roots," and "whose drink was the crystal well," it is abundanty manifest how beneficial is a reasonable portion of animal aliment, to the present habits and constitution of man, in our northern climes, it being more nutritious, and more abounding in azotic properties. We notice the proofs furnished by the experiments of Magendie, and many others, and of Dr. Stark on himself, that no food can long sustain human life, in vigorous health, if such diet be altogether destitute of azote. Hence it is that the diabetic patient is fed on muscular flesh, skate, and such animal nourishment as is highly azotized; fat meat, however, is not so, though sometimes given in this country to those suffering under diabetes. The fibrinous food was adopted, because it was found to produce abundance of urea, itself one of the most azotized animal principles, and which is found wanting or difficient in the above-mentioned complaint, probably owing to the want of healthy affinity in the ultimate atoms, which would enable their combination to ascend to a due degree of azotic composition, as will be further alluded to, when we come to speak on that subject as a probable cause, of contributing in some degree to the evolution of animal heat.

Dogs fed on diabetic sugar, contracted diabetes mellitus, and were cured by the use of food containing large proportions of azote. But as urea abounds in gout and gravel, therefore animal diet is very hurtful to those threatened or afflicted with those disorders. Indeed, Magendie ascribes their prevalence to an over-use of animal food. It appears that the chyle it affords abounds much more in albumen, than that from vegetable substances, and is, therefore, better adapted for supporting those who are subject to dyspepsia, as the chyle from animal food does not readily run into the acetous fermentation, but continues to afford strength to the digestive organs which have been weakened or diseased. Though the analogy does not directly hold, yet we may mention the circumstance, which is already proved, that a dog can subsist on flesh and water alone, but cannot live on sugar, butter, olive oil, or gum. One is described as having been fed on sugar and distilled water, who died in thirty-two days: the urine was alkaline, containing no uric acid, or phosphates. The valuable labours of Magendie, Paris, &c., render it unnecessary to dilate further on this department of the subject.

Nothing can afford more striking proofs of the importance of attending to the qualities of food, than to observe the extensive changes and varieties occasioned on animal organization by different kinds of aliment. Many of those modifications and changes are well known to the epicure, as well as the admirer of nature. The particles of vegetables even enter the secretions, affording new properties and compositions. Bitters enter the circulation, and are detected in the fluids. The milk of the goat partakes of the taste of the bitter bark on which it feeds.

The nature of the food has a considerable effect as well on the stomach itself, as on the entire system. Dr. Duncan relates, in his invaluable lectures, that a horse at Lyons ate a great quantity of oak-bark; after which, the coats of his stomach were three times thicker than usual. Here the tannin had power to affect the living membranes.

With respect to fish, much diversity of opinion long prevailed regarding the salubrity of that species of animal food. It has been well stated by many writers, and is indeed probable, that more harm results from the mode of cooking, preserving and drying fish, and from the rich and indigestible sauces, and fat mixture of butter and flour, and mushrooms and peppers, than accrues from the general properties of the fish itself, if not taken in excess. The religious rites of some countries bore a relation to the supposed salubrity of their food. The Jews were interdicted from the flesh of swine, and of other animals difficult of digestion. The sacerdotal rites of Ceres could not be performed, either among the Greeks or Romans, if the performers did not entirely abstain from beans, which were pronounced very unwholesome by Aristotle. The priests of Egypt were forbidden to eat fish. On the other hand, some nations used fish as almost their sole sustenance, and hence the appellation of ichthy ophagi, given to such people by Herodotus. Some tribes of the Cochin Chinese, who lead their lives constantly in boats, subsist on fish alone.

From experience, however, I can affirm, that cases of epilepsy occur much oftener among those who are indigent, and are in the habit of eating pork steaks, on ac-

count of the low price, than among any other classes.*
I have noticed the same in districts where the people are poor, and frequently make use of herrings: they and their children are very liable to fits of epilepsy, of that character which originates in disordered digestion, and acrimony of the contents of the stomach and bowels, which cases are best relieved by gentle emetics, followed by magnesia, vegetable tonics, and valerian.

As the mass of animal matter is originally formed from vegetable origin, so these again have been held by Van Helmont to arise from air and water. One thing, however, is clear, that the solids are but altered fluids, subject to return again to their former or some other liquid condition, or to be dissipated as if evaporated away. The largest muscles of a limb, when dried, become as light and thin as shreds of paper. Whether we confine our remarks to solid or liquid aliments, the *quantity*, as well as the *quality*, should be considered. The conformation of the digestive organs of man is adapted for food of considerable bulk: if nourishment from grain could be concentrated as Quinine is from bark, it would not long support men in a healthy state. If the stomach and bowels do not receive a supply sufficient to maintain a moderate extension of their vascular teguments and membranes, there is not a due stimulus to excite the secretions and peristaltic motions, which are required to dissolve and assimilate the pabulum. Add to this, that if a

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* This observation does not exactly agree with the experiments of Sir A. Cooper, who found fat pork more digested than other food, on opening the stomachs of animals fed for the trial; but the consequences above stated, I have long found to follow the use of the various kinds of swine's flesh sold to the poor, at the provision yards. Probably fat meat, being more easily melted than other parts of flesh, may seem to disappear sooner in the stomach, but at the same time it may be only dissolved, not digested.

minute portion only of nutritious particles were taken, the collapsed viscera would cover and close up the mouths of the lacteals and absorbents, as well as of the exhalants of the part, and little or no chyle would be sent to the thoracic duct. Over-distension, on the other hand, fatigues the fibres which form the coats of the stomach and bowels, pressing and closing the mouths and sides of the vessels. It will be seen how much Cobbett erred when he condemned the potato, and other roots which convey nourishment in a considerable bulk of the substance. The horse would waste and decay, if fed on the nutritious extracts only which could be taken from his hay and oats, if the woody and fibrous parts were rejected. In like manner, if a man be supported on the starch alone, which is taken from roots and seeds, his gums become soft and spongy, pulse feeble, the fibrine diminishes in his blood, ulcers break out, and he becomes pale and scorbutic: but the same roots and seeds, if given with all their other bulky constituents and pulpy mass, will, under certain circumstances, be sufficient to maintain the man in an ordinary state of sound constitution. But as treating of the varieties of different kinds of aliment is foreign to our purpose, we return to the subject of the differences which dilution and altered temperature produce on digestion. Nothing proves the propriety of dilution and proper separation of the organic particles of food more forcibly, than to observe the important advantages resulting from the proper mastication of the alimentary substances. For besides the benefits arising from minute comminution and subdivision of the particles, the abundant secretion of saliva which mastication occasions, mixes with the pulpy matter during chewing and deglutition, and brings it at once under the digestive process, throughout every part of the mass. Any person anxious on subjects of this kind, can readily establish a conviction of the above facts, by simple experiments. Let him chew as much food as is usually taken at one meal, for a certain period, say two hours, and set aside this mass, as it is chewed, in a bladder kept warm and moist with vapour, or water raised to 104 degrees; he will find that a kind of progressive digestion of the pulp will take place, as Spallanzani long since pointed out.* Let him repeat this process on the same quantity of alimentary matter, under similar circumstances, but with this difference, that he only chews a like weight for the space of ten or twenty minutes: he will then find that there is not by any means such a weight of moisture acquired, during mastication, by the latter mass, and that in place of digesting, when placed as the other is, the solid parts will remain, and the more liquid portion will soon run into the acetous fermentation. The experiment here directed, strengthens the notion that digestion can take place, to a certain degree, without the peculiar juice called *gastric.*† Another argument against its separate existence is, that if such an active liquid were secreted by or into the stomach, the poignancy of hunger would increase in the direct ratio of the absence of food, and of the length of time the stomach would be empty; but this is not the case: hunger will tease for a time, and then cease, without any food, again begin, and again relax, and at last terminate in more and more intolerable thirst, which is occasioned, as I suppose, *positively*, by the absorption of all the fluids that the empty vessels can drink in from

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* M. de Montegre denies that artficial digestion can take place, as held by this philosopher.

† How great a comprehension of the nature of things did it require to make a menstruum that should corrode all sorts of flesh coming into the stomach, and yet not the stomach itself, which is also flesh!—*Dr. Grew's Cosmol. Sacr. c.* 4.

the entire surfaces of the mouth, fauces, and the first passages throughout; and, *negatively*, by the cessation of the usual secretions which moisten these extensive surfaces over all their circuits and convolutions. From these and many other considerations, particularly the want of glandular structure, sufficient to account for the separation of a liquor, sui generis, of such potency as the gastric juice is said to be, reasonable doubts may certainly arise. A combination of the salivary mucous, lymphatic, pancreatic, bilious, and other secretions and liquors, meeting in the stomach and duodenum, acting and acted upon by the food, may produce a *combination* capable of effecting, together, what none of the fluids could *singly* perform; and the juice called *gastric*, may be merely a compound menstruum, aided by heat, fluidity, and motion, inducing a new progressive arrangement of ultimate elements, disposing the proximate principles of the food to be decomposed from their present order, and to be attracted, in new modifications, to constitute the basis of those nutrient atoms developing in the chyme, becoming more animalized and assimilated in the chyle, and at length perfected, when commixed in the half regurgitating cavities of the heart, and spread out to the agency of the atmosphere, over the wide extending, spongy ramifications of the lungs. Though it would be both presumptuous and difficult, to question the long established doctrine of the "gastric juice," which dissolved pieces of bone, in perforated cases introduced into the stomach, yet, as others have for some time doubted its peculiar character, I beg leave to adduce a few reasons why I would incline to be sceptical on the point.

1st. From the coagulating power attributed to it, being most potent in the membranes of the stomachs of young calves, who have little food to digest, and of course less need for such a powerful menstruum.

2d. From the great quantity of saliva (about half a pound*) secreted during a meal to mix with the food, and without which, the appetite and digestion would be lost, as was proved by Ruysch, in the case of a person who had a fistula in the salivary ducts. The same loss of appetite is experienced by those who keep constantly spitting out mucus and saliva, on beginning to smoke tobacco, and on being disgusted by any object, or subjected to mercurial or other salivation.

3d. From the importance of the *pancreatic liquor* which, if obstructed, or vitiated by disease of the gland, is productive of extreme emaciation.

4th. From the circumstance, that, where there is chronic enlargement, induration, or even schirrus of the gastric glands, there is a conversion of solid food into chyme, superior to what could take place, if these glands secreted the only liquor adapted to chylification and dissolution of the aliment.

Dilution and warm temperature greatly accelerate that change made on the elements of digestible matter, adapting it to a condition fit for nutrition, by an alteration of the ultimate elements, or at least of the proximate principles. Hence, one part of what we take will digest, another not: it is not from any elective sentient perception of the stomach, or of the solvent fluid, that they will reject the chaff of grain, or the epidermis of a bulbous root; but because these are not decomposed, nor their constitution deranged by such solvents and heat. When the ichneumon fly deposits her eggs in the body of the catterpillar, the young insects devour every part of the

* Dr. Fordyce estimated the secretion of saliva, during a meal, only at an ounce or two, and that its use was merely to lubricate the passages through which the food has to pass. But persons who attempted suicide, have been known to discharge eight to ten ounces of saliva at the wound, whilst feeding.

nympha, except the vital organs. Naturalists attributed their exemption to some wise provision or instinct on the part of the young ichneumon, which permitted the important organs of its living nidus to exist till it had itself reached maturity; but it was not its provision or instinct which enabled the vessels necessary for supporting life, to resist the decomposition caused by the foreign irritation of a living parasitic, and to remain solid and undissolved, whilst softer and less essential parts ran into a more liquid state, adapted to the young insects' nourishment. The nutrient canal lived and resisted its burrowing destruction, as the femoral artery will live and beat in the purulent hollow of an eating and devouring phagedenic bubo, or mecurial ulcer in the groin; or as the tendons and muscles will shine untouched when the cellular membrane lies dead in the deep destruction of such parts, in cases of erethematous ulcerations, or after diffuse cellular inflammation, when the subcuticular tissue can be pulled out like shreds of wet tow, or pieces of decomposed hemp. These things show that one part is more easily reduced than another. The husk of the oat, when perfect, will often defend the grain from the active digestive powers of the stomachs of the cow; and the soft skin of the potato will pass away untouched through the voracious concocting organs of the swine, not because the stomach (or gastric juice, if such there be,) exerts any sensibility, percipient or latent, whereby it dissolves what is nutrient of the seed or root, and rejects what is not; but because the atoms, of which the rejected matters are composed, remain still united by an attraction, superior to any divellent powers which moisture, warmth, trituration, friction, peristaltic motion, mixture of digesting secretions, or any other causes can bring to act upon them. Whereas, the elements of nutrient matter can be decomposed by moisture and moderate temperature alone.

The epidermis of all living and organized bodies, is in a wonderful manner incorruptible. In the deep recesses of the tomb, when all other parts are reduced to kindred dust, the hair and skin, but especially that of the thickened palm, sole of the foot, and heel, still remain, and retain their shape. In like manner, the epidermis of all seeds may be found in the earth, long after the nourishing contents that fed the plant had disappeared. The same resistance to decomposition is their essence and character in the stomach, and alimentary passages of man, and every other animal.

The digesting secretions, liquors, and mixtures, act the part, in decomposing nourishing substances, that yeast does in inducing fermentation; not that they act as a ferment, but that they break up the former constitution and relative proportion of the atoms, and then leave them disorganized, and ready for any new combination, or altered conformation or quality, into which new and active affinities may tend to join them in a healthy state. If the opinion were tenable, that the gastric juice is nothing but the saliva which descends into the stomach, mixed with other secretions, one would incline to explain the reason why that fluid does not act on the living stomach. It may be this, that the ultimate elements and proximate principles of the stomach, are attached, during their living attractions, with a greater affinity than the decomposing solvent liquids can produce or exert over them: and we might then as well expect to find a gland corroded or affected by the liquid it secretes, as the living stomach by the fluids which glide into it, to dil~~a~~ute, divide, and eliminate our nutrition. But on dead animal membranes, or food, the solvent action can exert its agency, because then decomposition is more easily effected; for the dead matter would soon change its ultimate constitution of itself, and run into a different state from that of its organization, when alive.

I would dissent from any thing advanced by that accurate philosopher, Professor Thompson, of Glasgow, with great hesitation. He has written a very ingenious paper, to show that marine acid takes the greatest share in the process of digestion. Doctor Prout holds a similar opinion* with Tiedemann and Gmelin; but we are aware that the nutritive process goes on, though the person has taken alkalies previous to and during the process of the assimilation of the food. Nothing is more common than taking soda pills, compound spirits of hartshorn, dissolved and calcined magnesia, before and after meals, and soda water is a beverage at table; yet the functions of the stomach and bowels are active, though if any marine or other acid were present, it must be more than neutralized. The same objection also applies against the theory of Van Helmont, who maintained that a subtle acid is the medium of dissolving the food. I remember the case of "Old Becky," an indigent little woman, who lived in one of the small houses belonging to the poor-house, (20 years ago): she had a fistulous opening in the abdomen, from which the white chyle would run, after every meal. It seldom or ever was found either acid or alkaline, or affected the vegetable blues, or other tests. Since that time, Richerand met with a similar case. Whatever is the solvent of alimentary substances, or has the power to alter their nature, or change their composition, certain it is, that a considerable evolution of animal heat takes place, called by the ancients, *fever* of digestion; and as this heat seems to concentrate itself in the epigastric region, and as during the alimentary solution the cardiac and pyloric openings remain perfectly closed, no external con-

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* Philis. Trans. 1824.

tact of air, vapour, or other promoter of heat, can enter by the œsophagus from the atmosphere; and we naturally look for the source of this higher temperature, as originating from the substances taken into the stomach as food and drink, and the evolution which a change of aggregation and alteration of alimentary composition bring about, whilst such mutations are in progress. That this heat is not derived through the circulation from the lungs, we infer from this circumstance: that it is at first local about the stomach, not diffused, as if sent by the lungs or arteries, and that it advances and increases, long before the pylorus permits the assimilated chyme to pass, or before the lacteals begin to send the new chyle to be mingled in the heart, or expose it to the influence of respiration.

Speaking of the utility of natural *local* warmth, in promoting digestion in the stomach, and reciprocally of assimilation, as a source of *general animal* heat through the whole system, I do not remember whether the principal uses I ascribe to the spleen have been guessed at by any of the other theorists, among the thousand and one offices which have been assigned to that organ. The spleen is a large spongy mass, on which the splenic portion of the stomach rests, almost in contact with the food about to be digested; and as it receives a very large quantity of blood, hot from the adjoining heart, this warm stream may contribute caloric, as from a reservoir, to the stomach and its contents, until the alimentary pulp be raised to the temperature of the blood at its fountain head. Whether this idea of a focus for diffusing heat to the stomach and ingesta, with great rapidity, be a correct notion or not, I do not pretend to affirm; but the detention of the blood, until it have time to distribute heat by communication, seems provided for by the structure of the spleen: this is more apparent, from the large capacity of the arterial branches in proportion to the trunks. The food is more than an hour in the stomach before the chemical changes proceed.

If we suppose, for instance, that one meal, solid and fluid, shall weigh fifty ounces, and estimate its temperature at 50 degrees of heat. If we imagine that a jet of blood pervades the spleen at each pulsation, amounting in quantity to two ounces, and the temperature 100°. If we say that each ounce, as it passes through the spleen, shall part (on an average) with one degree of heat to an ounce of the colder pulp in the stomach; and suppose there are seventy pulsations per minute, and two ounces transmitted at each, then the fifty ounces of aliment would be raised to 100 degrees in about twenty-five minutes, by the constant current of hot blood passing under it, and calculated at the above rate.

No doubt the other organs in contact with the stomach would communicate caloric to it, as long as it is colder, or contains colder matter; but these organs have well assigned duties and functions to discharge, and it might retard or lessen their power, if obliged to contribute their natural heat to the stomach, as often as it might be filled with cold drink or meat: they are not like the spleen, which seems to have an influx for accumulating or affording caloric, degree by degree, as it fills and empties; and, having no secretion to prepare, it seems certainly auxiliary and tributary to the stomach, like the bee, which labours not for itself.

"Sic vos non vobis mellificatis apes."

There is probably another use of the spleen, which I infer from the colour of its blood. It will be shown, elsewhere, that if you add to a phial of florid arterial blood a few drops of water, and agitate, you instantly convert it into venous: now the blood in the spleen exhibits a black colour, and is more watery than when it entered; and as the mass of meat and drink we take into the stomach is soon rendered more inspissated and consistent, and of a thick pulpy texture, however liquid when taken, we might be led to attribute its speedy solidification to the quick disappearance of its aqueous part. As the splenic vessels are capable of immediate distension, (the "vital turgescence" of Riel, Ackermann, and others); as there is a disproportion between its arterial and venous system, the latter being much greater, and the blood more aqueous, we would incline to think, that this mass of *erectile tissue*,* on its sudden enlargement, might be capable of imbibing or drawing in the finer or thinner liquors from the stomach, either by the vasa brevia, or some other communication, or by percolation itself, when in close contact with that viscus. Is it by the accession of this water, as well as by giving out caloric, that the splenic blood becomes dark? We are aware that the hand, or any living part, will become blue, when rapidly dissipating caloric to a cold solid or fluid body; the colour occasioned by its becoming more dark in the veins, and acquiring a different state of aggregation.

Even these properties would be more conformable to the truth, "that *nothing was made in vain*," than the hypothesis of those who think the spleen of no use, because John Hunter cut it out of a man who did well. Mayo dissected it from a dog, which became very fat; and because the viscus has no visible secretion or excretory duct.

In alluding to the spleen as a source of temporary and topical temperature, during the interval which elapses from the taking of the food till the digestive changes begin, I am well aware how much ridicule *a few* of the

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* Beclard.

friendly fraternity will endeavour to fasten on the hypotheses scattered up and down in this thesis; which theories they will find, as they dip (free of expense) among its uncut leaves, if by any chance it should be printed and offered for sale at the booksellers'. Notwithstanding the honour of these gentlemen's hostility, (for it is expected,) we are inclined to think that the theories here advanced may admit of some defence, and will, therefore, continue our explanations regarding the spleen, which has been proverbial for engendering the splenetic feeling above alluded to.

When we remember how the sufferer from a diseased spleen will tell you that a constant coldness is felt in one part of the stomach; and when, after death, you dissect this person, and find the spleen a passive, cavernous, diseased honeycomb, the pathological inference must forcibly strike the mind.

Let a delicate person stand but a few minutes on damp, cold ground, or in wet shoes, and there is directly a determination of heat from the centre towards the lower extremities: ask the person what part feels the want of that heat so directed elsewhere,—the hand is immediately laid over the spleen, but the painful sensation is referred to the stomach; both organs sensibly perceive the loss. In this country, if an old woman come to complain of indigestion, acidities, flatulence, pain of left side, languor, indolence, and so much coldness of stomach, as, in her own opinion, to require cordials,—if you ask her complaint, she answers, her disease is the "spleen." This metonymia of the organ for the disorder is so common, and so long customary, that there must have been a period, when it was as fashionable, and, probably, as correct, to have an affection of the "spleen," as it is now to suffer from the "liver," the "bile," the "nerves," or any other periodical appellation of maladies, *en masse*.

It was rightly held, that organic matter can only be formed from organic. Cuvier said, "life must spring from life." But when we come to reflect on the generation of animal heat, as well as the utility of warmth in the processes of nutrition, we may admit that the organic principles must be changed before they are applied to increase or renovate the parts to which they are destined. Even in the support of vegetables, the crude sap does not nourish until it be mixed with lymph already digested and deposited in the cells of the alburnum.* We cannot allow the idea, that, if we take in gelatin, it will serve as gelatin in our bodies, albumen as albumen, or fibrine as fibrine. These proximate principles may each increase their own kind, when much used, as was said, in speaking of diabetes, but previously require to be altered and modified, unmade and made up again. No chemist or physiologist can distinguish between the blood of a kid and that of a lamb, and yet the transfusion of the former into the veins of the latter, may prove destructive to its life, although a priori we would be led to believe the blood of such animals to be perfectly uniform and homogeneous, at least infinitely more so than the alimentary principles of any animal or vegetable food.

It is, therefore, more consonant to reason and experience to believe, what experiment has tended to confirm, that few or none of the nutrient principles we take in, pass, in their original state, to the mass of arterial blood, but break up their compounds, undergo divellent attractions, and decompositions, and rejoin *de novo* in proportionals suited to reunite or renovate the system into which they are about to enter. For if the substances taken from animals as food, though nearly of the same

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* Dr. Knight.

qualities with the material of the human body, required only mixture and solution to assimilate them as nutrient matter, without any change of qualities, or relative constituent animalized nourishment, then no evolution of higher temperature would be produced, because no chemical alteration would take place in the solid or fluid aliment. The stomach can exert, over the mass of in-jesta, a power fit to convert the various principles of different materials into eliminated chyme, just as cooking, boiling, roasting, drying, and blanching, can deprive many vegetables of acrid, or even poisonous properties, converting them into bland, mild, and demulcent nourishment. The Palma Christi bean, which produces the castor oil, and which would of itself be sufficient to prove fatal, when eaten, is rendered a very mild diet by boiling. The same may be said of the acrid arum, and the deleterious horse-chesnut.* "The cassada plant, unprepared, poisoneth; but prepared, is the very bread of the West Indies."† "It is of the most general use of any provisions all over the West Indies, especially in the hotter parts, and is used to victual ships."‡

If permitted to adduce a very humble, but simple example, illustrative of the necessary dilution and minute division of solid food, during mastication, we can refer to the quantity of dry vegetable aliment taken by a horse. If we feed a cow on the same, what she eats being subjected, through the ruminating process, to a second comminution and deglutition, perfect admixture with the salivary and other secretions, to long continued detention, digestion, and commixture in the different stomachs, it is operated upon so perfectly, as to give up most of its

* Parmentier, sur les vegetaux nourissans.

† Derham.

‡ Sloan's Nat. Hist. of Jamaica, vol. I. chap. 5.

nutrient principle, whilst the residuum which remains, like the *caput mortuum* of the ancients, is inert and wasted matter; but the horse who feeds on the same fodder eats large quantities, and does not subject it to the long and repeated grinding and dilution, which the cow does, passes it away, having abstracted much less of its alimentary aliments; and the consequence is, that often the material, bulky and half digested, passes through the primæ viæ,—the chemical decompositions, and new products are still going on, and the evolution of heat rapidly taking place and continuing, under proper circumstances and exclusion from air, to extend to such a degree as to reach a very high temperature, which is applied to various purposes in animal and vegetable economy, such as furthering incubation and promoting germination.

In hot and dry weather, ruminating animals consume the most of their time in chewing the cud, because the provender is arid, and requires to be again brought up and softened into a pap, with the salivary and mucus secretions; whereas, in wet or moist days, watery pasture, and dewy mornings, the animals graze without intermission, because they take in plenty of moisture with the grass itself.

Mr. Brown lately introduced to the world some new and beautiful theories, tending to show that matter, whether organic or not, consists of molecules which seem endued with vitality. The presence of water or fluidity, appears essential towards the exertion of the phenomena indicative of the mobility attributed to them by Mr. Brown. This theory would alter the ideas set forth by Kant, and held so universally, that the growth of inanimate bodies proceeds from the mere juxta position of inorganic particles. If we can believe that the molecules of coal or marble are composed of minute moving bodies, then we have a more philosophic and better reason for their remaining in one condition, if not acted on by external agents, than the dark and doubtful power of that convenient cloak of sluggishness called vis inertiæ.

That the fountain of the warmth, so conducive itself to the solubility of aliment, is not derived from the nerves, at least not directly, may be inferred from this, that though tying the pneumo-gastric, or eighth pair, deranges digestion, it does not prevent the diffusion of heat in the stomach from food, though the brain has certainly a most intimate connexion with the stomach, and gave the ancients some room for making the cardia the seat of the soul.

Dr. Wilson Philip thinks that the nerves exert their powers by galvanism in regulating digestion; for when the par vagum is tied on both sides, the stomach ceases to act; but galvanism below the ligatures restores the nervous action. However, if we admit that digestion is principally dependent on a certain admixture and dissosolution of the food with the secretions of the various digestive fluids, and that these, at a certain temperature, can dispose the aliment to become dissolved and assimilated, we have less occasion to resort to such agencies as those of galvanism, to explain the process of digestion. That these secretions, aided by a certain degree of heat, are capable of converting the aliment into chyme, has been asserted by many physiologists. It is known that animal heat is evolved, and secretions may go on, independent of nervous action, for monsters who have no brain, have regular secretions. Urine is separated from the blood by the kidneys, after the renal nerves are divided. Mucus is thrown out in the pulmonary cells, after the par vagum is cut; so that, as will be hereafter stated, it is probable that nerves are but indirect agents in digestion, or evolution of heat, tending merely to dispose towards a condition of parts, calculated to discharge the respective offices of each viscus more efficiently.

The idea that temperature, and a proper admixture of diluent secretions and solvent fluids, are the chief agents converting food into chyme, and not nervous or galvanic action, is still more probable from this circumstance, that cutting the par vagum, and leaving the ends of the nerves in contact and apposition, does not stop the digestion; that dissecting out an intermediate piece of these nerves, leaving a space between their divided parts, only interrupts that process; and that if galvanism be resorted to, *pieces of glass*, or *other non-conductors*, are as efficient for conveying the galvanic stimulus from one cut end to the other, as if the nerves were conjoined by the best conductors. Four or five inches of the par vagum of a horse were taken out; after fasting some time, he ate his oats greedily:—he was killed eight hours after, and the stomach contained only half the food taken; the other half was converted into natural chyme and chyle.

If cutting out pieces of the par vagum interrupts digestion, can we be surprised? Does not the least personal violence, danger, or even bad news, banish appetite from the wisest man? and do not the most patient and tranquil persons feel as if a solid ball closed the passage to the stomach, from a sudden shock of sorrow, fear, or violence? and shall not the poor, tortured domestic animal, which we impale, also feel *stomached* at the untoward and unmerited torment he endures, in cutting away some of the most sensitive filaments and threads that bind him to his life? "Nutritive motion" has recently been assigned, in rather unexplained terms, as contributing to the evolution of some animal warmth. The meaning attached to the words, "nutritive motion," though employed by Magendie, and many other physiologists, is like the word "*vis*," questionable and undefined. When we do not know how to explain a change or process, or to express ourselves in language perfectly intelligible; or, when we wish to avoid the *charybdis* of theorizing about first principles, then the questionable phrases, "*motion*," "*force*," "*vital principle*," "*vis medicatrix naturæ*," "*vis a tergo*," "*vis insita*," "*vis nervea*," "*conservative energy*," all lend their convenient aid, discharging the ready duty of ancient auxiliaries.

"Cnei Pompeii veteres fidosque cliantes."*

Though chemical motions occur at insensible distances, yet, in the process of nutrition, so far as immediate growth, or formation of altered organised matter is concerned, we can scarcely say, with certainty, that there is "motion" of the particles of proximate principles, abstracting from that of the circulation, secretions, &c. The new material does not supplant the old with violence or force; the ultimate elements of the former substances are gradually changed and altered: some of these join the new elements, derived from the nourishment, as they present themselves; but all this is effected in a similar manner, as the shell is indurated on the testaceæ, and that the cartilaginous jelly in the limbs of the foetus is converted into bone. If names are things, it would be desirable to employ some better term than "vital action," or "force;" probably the "condition of acting" would convey the idea in a manner less apt to mislead. The great difficulty of arriving at any certain data in these mysterious matters, is acknowledged by all, and warn me to conclude this chapter, rather than adduce any more hypotheses. The nomenclature now in use, as well as the theories themselves, should be greatly simplified.

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* Sallust.

CAP. VI.

On Drink.

"Nec mora temperie, blandarum captus aquarum."
Ovid, Met. 4.

As connected more intimately with dilution, we now come to say a few words on common drinks, and liquid nourishment.

The copious secretions which take place internally from so many glands and serous membranes, and the great expenditure of lymph by insensible perspiration, deprive the blood of a large portion of its requisite fluidity. Hence the urgent necessity of supplying the loss by a due quantity of aqueous dilution. The unfortunate persons who were confined in the black-hole at Calcutta, suffered more from intolerable thirst, than any other sensation. The wretched shipwrecked mariners deplore the misery of thirst much more bitterly than that of hunger. Seignior Redi kept a number of capons, without either solid or liquid aliment, (not even water,) and not one survived the ninth day, but one to which he allowed water, drank it with avidity, and did not perish till the twentieth day. In fevers, and many other diseases, when the powers of assimilation are suppressed, and no food can be taken, the blood is deprived of its balance of aqueous constituents, and probably also rendered acrid or saline, (as the humoralist Pathologists long held,) from the deprivation of its former bland commixture and accustomed renewal: here the strong desires arise for refreshing diluting draughts, and cooling fruits, abounding in aqueous refrigerants. The considerable quantity of solvents requisite to retain salts, sugar, saline purgatives, &c., in solution, when the liquors are absorbing, (as was alluded to in chap. 4,) partly accounts for the urgent desire of drinking, and for the nervous uneasiness of the papillæ of the mucous surfaces of the mouth, fauces, pharynx, and œsophagus. In hot climates, the water itself is so fast absorbed when drank, and appropriated to dilute the various fluids and exhalations, that more is soon required; but if a little brandy or proof spirit be added, the mixture is not so soon abstracted from the stomach, nor the thirst so rapidly or so ardently renewed. This combination remaining much longer than the simple water, appeases more effectually the inclination to drink. Alcoholic fluids are not readily taken into the circulation; they exert a strong chemical affinity on water, and retain it with elective energy:—this is not the explanation given by physiologists, why a weak draft of dilute rum and water assuages thirst much better than water itself, most of them referring the fact to some new influence, operating through the medium of the nerves. The dread of too much indulging in humoral theories, or chemical attractive laws, deters me from entering further into these curious but interesting particulars.

During thirst, the secretion of mucus ceases almost entirely; but this is the *effect,* not the *cause:* the condition of the follicles is altered, and the membranes are thicker and more red.

The furred tongue is thought to be owing to an increased quantity of *vitiated mucus.* It is found, on most occasions, where there is thirst. Thirst arises generally from the rapid absorption of the thinner parts of the salivary fluids, and from their evaporation by the transit of the breath, which is then warmer, as after great exercise, febrile heat, or the use of stimulants. The crust left on the tongue, appears partly as a deposite, after the more watery liquids are removed, and is coloured and affected by the halitus, when more loaded in disease. These alterations may in some measure account for the state of the furred crust in typhus and other disorders. Dr. Paris, (page 32, on diet,) says "the red tongue, of a cherry colour, when accompanied with tenderness in the epigastric region, denotes organic mischief in the alimentary organs." This is very likely owing to a continuous over-redness extending along the villous membranes of the alimentary passages, and exhibiting a similar hue on the tongue. From some experiments which I made on sheep, it would appear, that their soft, spongy tongues have some power either of yielding up part of the heat of the animals by evaporation of their moisture, or otherwise, or else of imbibing some cooling properties from the air; for in hot seasons, when sheep are subjected to much driving, or exercise, the tongue is kept very much in motion, and thrust out of the mouth; and on binding up the mouths of some, and hindering this exposure of the tongues, the animals so prevented from the above luxury, seemed distressed during a journey, and their temperature was raised higher than that of the others, as if the heat were confined and accumulated. A similar circumstance has been observed of dogs, who do not perspire.

Allusion has already been made to the temperature of drinks, and the differences occasioned by the alternations of heat and cold. Every person has observed how a glass of hot wine revives the sinking system, in bad cases of putrid or low fevers, in asphyxia, and all cases of debility, much quicker and more actively, than double the quantity of cold wine. "A heart that has ceased beating, will even resume its action when immersed in warm water."* The comparative qualities of the various liquids taken for nourishment, as well as to allay thirst, have been

* Thomson's Dispensatory, 1004. Dr. Whytt, &c. &c.

also a source of much discussion and difference of opinion. Few of these have occupied more attention than the use and abuse of tea and coffee, and the relative merits or demerits of each.

It will be said by every trembling old lady, who shakes, while she quaffs her dark decoction, called tea, that this beverage enlivens her spirits, dilutes her food, and warms and animates her entire frame. It unfortunately happens, that the leaves she infuses, are a collection of various kinds and qualities, about which the consumer knows little, but that they occasion tremours, and nervous and irregular palpitations. As to diluting the food, that is certainly an important and beneficial result, when a good breakfast of solid diet is taken and relished, and for which purpose a proper infusion of *good tea*, would be very well adapted. But when there is *nothing to dilute*, but the half tanned membranes of the stomach, which can neither receive, nor digest aliment, then such dilution, particularly with the same astringent liquor, would be particularly prejudicial indeed.

A decoction of coffee, though probably in itself not superior to an infusion of genuine tea, yet as it is more nutritive than the product of a dried leaf, and as the chance of obtaining the former article unmixed and pure, is, as one thousand to one, I therefore think, that the superior value of the coffee, over tea, to the people in general, stands in the same ratio. Coffee has, moreover, an inestimable advantage, which is duly appreciated on the continent, where its value is turned to useful account. There the people immediately dilute their dinner with their coffee, and with it appease the natural cravings which a full meal of ordinary food seldom fails to excite, in the digestive organs, for liquids of some kind; but we who disdain to follow an example so worthy of imitation, quaff off libations of all sorts of wine, stimulating cordials, and inebriating drinks. However, even in this country, I have known an agreeable wife to succeed in breaking off the bad habits of her husband, by supplying him, during his anxious desire for drink after dinner, with abundance of good coffee.

The interval of four or five hours, recommended by Dr. Paris, between dinner and tea or coffee, is much too long. "Drink favours the digestion of the aliments: this effect is probably produced in various manners; those that are watery, soften, divide, dissolve, even certain foods; they aid in this manner their chymification, and their passage through the pylorus."* With regard to dilution during meals, the middle course is safest. When the diet itself is vegetable, or soft and abounding in moisture, then little or no fluids are requisite; but when the food is solid, hard, and concentrated, or when eaten too fast, and not mixed with sufficient saliva, or consists mostly of animal aliment, then it should be moistened with a reasonable proportion of drink, and the more so in hot seasons or climates. If too much liquid be taken, then the solvent juices proper to the digestive organs may be partially washed away, or too much separated and weakened, to act with sufficient effect on the substances submitted to their operation.

Drink at dinner, is more requisite after roasted than boiled meat; because the former has parted with some of its constituent water, during the roasting, by evaporation; hence it looses one-third of its weight, whilst boiled meat only diminishes one-fifth; and hence, also, one pound of roast meat contains nearly as much nutritive matter, as two of boiled.

The temperature of the drink during dinner, is a matter of great moment. At seasons when the thermometer

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* Magendie, by Milligan, p. 282.

stands many degrees below that of the human heat, I have observed much harm to follow the practice of drinking very cold fluids too freely; an inconvenience results from it which is very unpleasant.—When fat meats, or sauces composed partly of butter, are taken, and cold drink directly after, the butter and fat are rendered concrete, and separated from the rest of the aliment. This congealed oily matter, being then specifically lighter than the remaining contents of the stomach, swims on the top of the food, often causing heavy, uneasy, and painful sensations about the cardia and breast; and sometimes a feeling of scalding and anxiety: at other times, when the stomach regains its heat, this fatty matter is rejected by little and little, from weak stomachs, in oily regurgitations, which are very disagreeable. In such cases, a little compound spirits of hartshorn, with a glass of warm water and sugar, will convert the fat into a soap, and give instant relief.

From some experiments already hinted at, it appears that the process of digestion, of alimentary matters, with the solvent liquors, can in some measure be imitated out of the body, provided a proper heat be maintained. It would, therefore, appear more reasonable to conclude, that as temperature has such influence, fluids taken with warm food, would be more congenial, if moderately warm also. In point of fact, those careful persons, who drink tepid toast water, during dinner, suffer seldom, and very little from spasm, flatulence, oppression, or other consequences of indigestion. Juvenal, sat. 5th, shows us, that the Romans drank warm water during meals.

It would be waste of time to detain the reader on the use and abuse of wines, spirits, and malt liquors,* enough

* Cæsar found beer the beverage of the Britons, nearly nineteen hundred years ago.

having been advanced on these matters in works on ethics and dietetics. Suffice it to say, that if it were generally known how much the alteration of a few elementary combinations varies the results, more attention would be paid to the condition produced by different drinks. As the abstraction, or addition, of a single figure in arithmetic changes the product, so the loss or alteration of an atom will vary the economy of minute organization; and, probably, produce a state of a part dissimilar to what would be otherwise constituted and evolved. With regard to the vast variety of drinks, and their effects in nutrition, they are capable of being rendered instruments of important utility, or the reverse. When we reflect that we administer certain substances with a view of changing a diseased state of the body, or its parts, into one of health, we ought to remember, that if what we take for medicine have the power to change a disordered into a sane condition; so what we take as drink, may be capable of similar properties. On the other hand, if medicines, or food of particular qualities, can produce certain unhealthy actions, or states of combinations of principles, not consonant to the laws and orders constituting healthy relations of our integral parts, drinks, from their active potency, may be rendered peculiarly competent to injure or destroy. But, like diet, so drink may be regulated and managed, as to fulfil the intentions even of remedies, and to modify or aid all their indications; and may, in many cases, be made the medium of reinstating and preserving the life of man in long continued uniformity of salubrity and welfare. Heat changes the properties and qualities of solid as well as fluid aliment, and alters their very elements, sometimes for the better, sometimes for the worse. Thus Vogel well remarks, that a quantity of bitter almonds can be given in emulsion with impunity, which, by distillation in water, would destroy life. In like manner, nothing proves the importance of mixing and diluting spirituous draughts more forcibly than this circumstance, that a person can drink a bottle of wine, at one sitting; with seeming impunity, and will be able to walk home; whereas, if he drank the alcohol contained in the wine, in a separate state, it would intoxicate dangerously, as it amounts to twenty parts in the hundred of alcohol in strong wine. Sugar and hot water, also, qualify the agency of spirits on the nerves, and retard its rapidity of chemical action; the same diminution of activity follows their dilution, with lemons and other acid drinks.

To recapitulate the advantages of pure water over every ordinary drink, would be to repeat what thousands of able writers have already proved. Somewhere in the Phil. Transactions, we have an instance of a clergyman of the Church of England, who, on account of an asthma, had for many years drank nothing but what was warm; but by once drinking a cold cup of beer on a journey, died in a few hours. Water is the strongest digester, and the best vehicle of our nourishment, being both the finest fluid and the most powerful dissolvent in nature: as it is the ordinary drink of the far greater part of the human race. The robust and valiant heroes of antiquity were drinkers of water alone.*

"Vina fugit gaudetque meris abstemius undis."†

With respect to the influence of diluting and dissolving aliment in general, we may revert to what was said respecting the necessity of attention to these matters, in such cases of STOMACH COMPLAINTS, where a fulness of the vessels, and an inflammatory disposition of the gastric

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* Derham's Physico Theology. † Ovid, Met. 15. 323.

tunics prevail, such as have been so well described and delineated by Dr. Armstrong. In these cases, solid food, like solid medicine, is prejudicial. It is here that warm, mild, and copious dilution is essential. Those persons only who have attended at numerous dissections, can believe how prevalent irregular patches of vascular fulness are found, as pathological proofs of the frequency of that source of stomach pains, and gastric complaints. They can affirm how much harm must have occurred to unfortunate patients so affected, from the too common prescription of beef-steaks and toast for food; and port and diluted brandy for drink; powdered bark, bitters, and carbonate of iron for medicine; and ginger, cordials, drams, confections, and spices, as *anti-flatulent aromatics;* and, inversely, how much benefit might be derived from soothing and softening the irritable surfaces with plenty of mild nutritious diluents, washing away acrid or offending matters, softening the superficies, on the principle of long continued fomentation, and disposing the elementary atoms to tend again towards the proportions of organic combinations, which had existed in, and are compatible with, a proper state of health.

On the other hand, in flaccidity of the digestive organs, in atony and debility of their fibres and functions, then the use of liquid diets, or diluting drinks, is fairly contra-indicated. In such states of these viscera, and where there is no plethora of the vessels, nor spasms of the nerves, solid and nourishing aliment, properly prepared and regulated, will be much more likely to do good, and to commence and preserve a more permanent degree of stimulus and tonic effect, particularly if confinement, damp, or bad air cannot be avoided. The reports of the Penitentiary, at Milbank, fully illustrate the truth of these reflections.

PART III. CAP. VII.

INFLUENCE OF DILUTION AND TEMPERATURE ON THE LIVING BODY.

HAVING endeavoured to show the utility of DILUTION, and the influence of TEMPERATURE on the organization and solution of medicinal substances, and on food, I come now to say a few words of the powers they exert on the living solid and fluid matters of the system. On the topic of animal heat itself, it would be presumption to dilate, in this small tentamen, the subject having been handled by the best and earliest names in medicine.

The importance of large dilution on the system during disease, and in regulating, moderating, and aiding the powers of medicine on the constitution, is unbounded. It modifies the actions of the products of animal, vegetable, and mineral remedies, on the frame, whether taken into the stomach or applied to the skin. Copious dilution will enable the living fibre to escape from the effects of certain portions of arsenic, cantharides, nitre, and such other substances, as, if given in the same quantity, in a solid or concentrated state, would inflame, corrode, and kill.

Temperature has, also, its never ceasing influence. For warm fluids will pass through the primæ viæ quicker than cold, owing to the gentle stimulus of the heat; and will more readily dissolve and remove viscid and saline matters, and relax irregular and spasmodic actions; whereas, a cold fluid often tends to produce or increase torpor and inaction of stomach and bowels.

When medicines are intended to open the pores, or pass to the kidneys, and where it may be necessary to prevent vomiting, then the exhibition of diluents must be avoided for some time, until the remedy have passed out of the stomach, and then copious and warm potations are desirable and beneficial.

Moisture and sudden changes of temperature, which exert so many and varied agencies on the human system, often produce changes that are very injurious to it. All know how dangerous are damp beds, wet clothes, and moist rooms or houses, attracting the caloric from the body, which converts, on all sides, the water into vapour or steam; thus producing cough, cynanche, rheumatism, pneumonia, phthisis, and death. We see, at the same time, how contagion is conducted by moist air, as electricity is conveyed by a metallic rod. We observe, that the contagion of epidemics is arrested by great rains, which wash the air of the heavy vapours, loaded with miasmata, and animal exuviæ. Hence, frost, as it congeals the water in the air, lessens the force of contagion; which, however, renews its devastations on the cessation of congelation and return of soft weather, if the frost be of too short duration. It appears to me, that *chlorine gas*, famous for fumigation, decomposes the water, of the air, the vehicle of infections, and then its vapours require to expel them, a more free ventilation, leaving a less loaded atmosphere.

The burning of Nitre, &c., is also useful, by drying the places, and expelling or dissipating mephitic moisture and dampness of rooms or hospital-wards, where they are the conductors of the deleterious poisons.

If the air we inhale were perfectly dry, there is reason to think no miasmata would be active or soluble in it; for it is the water in the air that keeps them in a state of communicability, fit to produce their effects.

Virus applied to the skin, does not act but when soft; and thus only can we communicate vaccine, or variolous matter, by inoculation.

If the moisture of the air be the vehicle of this contagious matter, how are we to remove the cause, and prevent the accession of the effects? The most speedy and economical mode of drying damp walls of houses, or air, is to place earthern pans, or large flat basins, in each apartment or room, half filled with strong sulphuric acid, which will abstract its own weight of water from the air, in a very short time.

No person who has not tried it, can estimate the sudden and great change thus produced on the air, if enough of acid be employed, and occasionally agitated with a rod.

When the acid is saturated with the moisture, it is still of equal value to the arts, such as bleaching, so that there is no loss in the process.

In like manner, broad open vessels of fresh burned lime, placed under beds, in damp apartments, soon absorb the humidity. Nor is the lime reduced to powder by the dampness it has imbibed, of less value, as a manure for the land, or a cement in building. Lime may be thus used to absorb the carbonic acid, and animal effluvia, where too many persons are crowded together. Query:—Do the men who sift lime, to purify gas for burning, take infectious diseases? or do those who burn lime escape fevers?

If the acid, or lime, be found disagreeable, dried salt of tartar, or muriate of lime, will answer; and the same salts may be used ad infinitum, by being well dried, from time to time, by the proper application of heat. Dried sand and plaster of Paris will rapidly absorb moisture, and, when heated, will give out ammonia, if they have been in contact with the skin, or any animal matter.

A small apparatus would render this purification, or some modification of it, readily applicable to every hospital. In places where any epidemic prevails, the houses of the inhabitants could be kept dry at very small expense. Nothing is easier than to make air pass through hot muriate of lime, in a furnace, for the supply of private or public buildings. In winter, this apparatus could be made to keep up any requisite degree of heat and dryness, so as to deprive the air of almost all its excess of humidity.

The air brought into the house, for the purpose of being dried or warmed, might be, by a tube sufficiently long, conducted from a stratum of atmosphere as elevated as the roof of the house itself, and probably the malaria be thus avoided; for it is a fact, that soldiers, in the upper stories of barracks, are sometimes free from intermittent fevers, and contagious maladies, with which their less elevated companions are attacked,—a proof that the miasmata ascend only a limited height, in their active state.

Is it to escape contagion, or that by breathing a purer and lighter air, his lungs may be less loaded, and his mind more serene, and less oppressed, that the garret has been long the chosen abode of the poet?

The matter of contagion is borne along near the earth, by the ponderous humid air, and the heavy watery vapours, which keep it condensed and ready to strike.

"Naribus humiferum duxere ex ære succum."

But if we dry and dissipate air, near the earth, or take it from a higher stratum, where the pressure is less, any given quantity of miasmata becomes more diffused, (or in a manner diluted,) and, consequently, less noxious. But man will be too liable to epidemic contagions, whilst he is doomed to breathe the impregnated moist effluvia exhaled from the soil on which he moves.

"Pestis et ira Deum stygiis sese extulit undis."

The day may, however, come, when purer air shall be introduced into houses from a more exalted region; or when art may render the atmosphere, usually breathed in large cities, more salubrious; which, in many cases, is driven up our sewers, loaded with moisture from every impure collection.

Pure water is sought as a great desideratum, being highly conducive to health. But the *quality* of the air, on which depends our being, though impregnated with loathsome, and even noxious ingredients, seems to be too much disregarded.

> "Ye who amid this feverish world would wear
> A body free of pains, of cares the mind,
> Fly the rank city; shun the turbid air;
> Breathe not the chaos of eternal smoke,
> And volatile corruption from the dead,
> The dying, sickening, and the living world
> Exhaled, to sully heaven's transparent dome
> With dim mortality. It is not air
> That from a thousand lungs reeks back to thine
> Sated with exhalations, rank and fell,
> The spoil of dunghills, and the putrid thaw
> Of nature; when from shape and texture she
> Relapsed into fighting elements.
> It is not air, but floats a nauseous mass
> Of all obscene, corrupt, offensive things."
>
> *Armstrong.*

Close stoves, to heat rooms, are not to be recommended. But a supply of pure air, in cold, damp seasons, made to pass through an apparatus calculated to dry and heat it, is greatly to be desired. To regulate, by the resources of science, the transitions of temperature to which our climate is liable, would confer, on the sick and infirm, a great blessing indeed.

The above modes of preventing the activity of contagion, and sources of illness, will apply, whether the air is the medium of conveying diseases to the lungs, or whether the vapour that keeps contagion in solution, is received into the blood. There is some reason to think, that the moisture is absorbed from the air, both by the skin and lungs; and that in this way the thin pervious membranes admit the vapour to the blood; that the skin admits it in the æriform state, may be safely allowed, and will be further attended to, when we come to speak of vapours and bathing.

The oilmen of Barbary, whose skins are in a great measure varnished, are known to be exempt from the plague: the aqueous vehicles of contagion cannot penetrate into their skins, (as the pores are stopped.) Eggs are preserved on the same principle.

Mariner, in his history of the Tonga Islands, page 260, states that the natives of those islands, to avoid catching cold, rub themselves over the entire surface with oil and turmeric, and that he tried it himself, and it had that effect. The men all use it in war, because they are then nearly naked. The rationale must be, that it hinders the exhalation of vapour, and consequent waste of caloric, and that more of the air and water is imbibed by the lungs, when the skin is sealed up.

Some experiments made on dilution and temperature, lead me to conclude, that the solids and fluids have, in a living state, a great attraction for water. In this manner I venture to account, in a considerable degree, for the continued *expenditure* and *renovation* of animal heat. If through the widely extended surface of skin and lungs, the blood, receiving the aqueous vapour from the air, combines with, and fixes it, in the state of simple water, or of new combinations of its elements with our solids and fluids, how much caloric must be thus set free? Suppose a given quantity of æriform water, in the atmosphere, to be combining with the substances of our system; the absorption and condensation of this vapour will contribute calorific warmth to supply a considerable portion of the extensive expenditure of animal temperature. But if it be still further granted, that the skin and lungs have the power of taking up vapour, and that the blood chemically fixes this vapour, either in solid or fluid combination as a hydrate, the caloric of fluidity must then be disengaged. Add to fresh quick-lime, or sulphuric acid, a due proportion of water, and you observe how abundantly caloric is liberated. As water forms a hydrate of lime, and gives out heat, why might it not be inferred, that it may combine in the mass of our solids with the principles of their particles, and justify such language as a *hydrate of fibrine*, in the blood and muscles; and a *hydrate of lime* or gelatine, in our bones. Our mass of matter is almost entirely water,—our elements absorb it on all sides.

"Querunt aquas in aquis et flumina liquida captant."

"Et documenta damus qua simus origine nati."*

This solidification of water, simple or æriform, and the consequent copious supply of heat, does not militate against the beautiful, but incompetent theories of Drs. Black and Crawford.

But though the eleven ounces of carbon, (the computed consumption for a man in twenty-four hours,) and the small modicum of heat resulting from the difference in the capacities of oxygen and carbonic acid gas, or of venous or arterial blood, may contribute a *share* of heat, yet if our temperature depended on such uncertain and inadequate supplies, I fear our blood would soon be ice.

"Solidis hœrent flumina lymphis."

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* Ovid, Met. I.

Our horses and oxen could ill afford to perspire so profusely, and emit volumes of warm steam; they also would be frozen.

> " Intereunt pecudes stant circumfusa pruinis
> Corpora magna boum."

Could fishermen, on so limited a supply of heat, stand up to the chin, for hours, in the tide, in charge of a salmon net,—the passing sea water, 30 or 40 degrees below that of their blood, in the meantime carrying off volumes of caloric from all parts of their bodies? " But when a soldier, said I, an't please your reverence, has been standing for twelve hours in the trenches, up to his knees in cold water,—or engaged, said I, for five months together, in long and dangerous marches, harassed, perhaps, in his rear to day; harassing others to-morrow,—detached here—countermanded there—resting this night out upon his arms—beat up in his shirt the next—benumbed in his joints, perhaps without straw in his tent to kneel on, he must say his prayers how and where he can." And warm himself too, *Trim* might have added, in some more effectual manner, than by the combustion of eleven ounces of charcoal, suppose he had it, or even admitting it would burn in the wet.

Though the laws of life sometimes are supposed to reject chemical regulations, and it is said we may have free carbonic acid, and free caustic soda agitated together, but not joining in our veins; still the notion that the blood can unite the vapour of water from the air, in a solid state, with the principles of our bodies, is not improbable, even where the temperature is above that of the vapour itself which is inhaled. Many proofs of such condensation might be adduced. Lime will take up and solidify water from the air, long after the temperature of the combined hydrate is above that of our lungs: and salt dissolved in water, will prevent it from boiling, until it reaches 13 or 14 degrees above 212°.

Besides the power of affinity, the influence of pressure is great. Withdraw pressure from water, and you convert it into vapour at 180°; and, on the other hand, you may increase the pressure, so as to keep it liquid at 400°.

Now, the æriform water enters the lungs, to a certain degree, in a state of vacuum, and is there presented to an absorbing surface, extending (as Keill says,) 21.906 inches of superficies. A pressure is then exerted on this inspired volume of air and water, probably much greater than that of the atmosphere, because, along with it, we have the power of contraction of so many strong respiratory muscles, and elastic costal cartilages.

This great compression and motion, as well as affinity, and other causes, condense the water: the oxygen combines with it at the moment of its nascent state of fluidity. Owing to its solubility in water under pressure, the blood takes up the oxygen thus presented in the liquid state, and along with it as much of the water itself as is requisite, at each inspiration, to dilute the solids and fluids. The remainder not thus taken up or required, is exhaled at the expiration or moment of compression, impregnated with carbonic acid gas; or the water thus conveying the gas out of the lungs is given out by the venous blood, and at the moment of becoming vapour, it abstracts and carries away the superabundant heat, which would otherwise accumulate.

Those who reflect, how much the confinement of water in deep vessels, and even how much faster a black vessel condenses than a shining one, (and the lungs are the blackest tissue in the body,) and who consider what small modifications induce great chemical changes, will not deny, that these attractions contribute, all more or less, to the production, regulation, and temperament of that vital heat, which promotes animation, digestion, circulation, and secretion.

"Unde cavæ tepido sudant humore lacunæ."

That respiration is not the sole cause of animal heat, may be collected from the thousand instances which could be adduced of extreme cold attendant and consequent on long fasting. The resolute criminal, Viterbi, who starved himself, lived from the 2d till the 21st December, without food. His principal sufferings were grievous thirst, and icy coldness.*

This opinion of the solidification of water, and consequent distribution of its copious latent heat, would aid us in accounting more satisfactorily for many changes in the phenomena of life.

First.—It might in some degree explain how animals have the power of resisting sudden and extensive vicissitudes of heat and cold. When the atmosphere is very frigid, the quantity of aqueous vapour is, *in a given bulk*, greater than in the same volume of hot air. And if we inhale, at each inspiration, 40 cubic inches of cold air, this quantity may contain double as much vapour of water, and, consequently, if that vapour be appropriated and solidified, may warm our frame with much more caloric, than would result from a diffused and rarer atmosphere; add to which, that such external cold air, generally speaking, abstracts less vapour from our surface, than dry hot air, which rapidly dissipates it. The last of these reasons is given why in Blagden's and Fordyce's experiments, Sir J. Banks, and others, could endure a heat of 260°, whilst that of the blood arose only from 5 to 7 degrees.

* Vide his case as described by Richerand.

The fellows of the Academy of Sciences, saw two girls enter into an oven, in which fruits and animal substances were baking. Reaumur's thermometer, which they took in with them, stood at 150 degrees. They remained several minutes in the oven, without suffering any inconvenience.*

But, as little or no water, can be present in the air of the oven, none can enter or join the blood either by skin or lungs, and no caloric of fluidity can be evolved : indeed, if moisture be present at these experiments, the skin is burned.

Delaroche kept a frog and wet sponges two hours in confined air, heated to 119°, the heat of the frog and sponges remained equal, but arose only to 82°. So that the moisture and evaporation of the wet sponges, kept the heat 37° lower than that of the oven.

The Frenchman, Mr. Chaubert, who lately exhibited here, remained in the oven till a shoulder of mutton, or a fowl, was roasted, both having abundance of moisture in their composition, whilst his heat did not increase more than 9 degrees, and never above fever heat; for the steam, leaving his body, abstracted many times more caloric than the lymph contained, before its conversion into vapour, whilst there was no aqueous vapour in the hot air to imbibe in return, to generate more animal heat in the blood.

Secondly.—The same reasons account, as well, for our greater expenditure of warmth in summer, and our larger production of it in winter; as for our being less thirsty in cold, than in heat, at night than by day; for the cold air affords more dilution to the fluids. It may be thus that the cold bath relieves thirst, and increases the flow

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* Richerand, p. 216.

of urinary secretion; and it may aid that genial glow of warmth occurring in health, and attributed to reaction, quantities of latent caloric being evolved from the absorbed water, the capacity of the watery mixture in the system, or of the blood, or even of the solids, for caloric, being perhaps less than that of the water itself, before being absorbed.

Thirdly.—This idea may partly account for the cutaneo-pulmonic sympathy, so well described by the accurate and indefatigable Dr. James Johnston. And it may explain how, on a momentary stopping of the inhalants of the skin, by a sudden plunge in cold water, the lungs are forced to perform double work, and take in two or three convulsive inspirations, panting for breath, till the inhalants, recovering from their spasmodic contractions, imbibe moisture, and the exhalants open again to discharge the excrementatious vapours washed from the blood, along with that proportion of caloric which that vapour takes up, and whose exit balances that already evolving in the frame. No doubt the nervous shock accounts for the prominent features of the phenomenon, and the notion here adduced explains it only in a minor degree.

Fourthly.—There is reason to think, that in the torrid climes, where the atmosphere is rarified during the heat of the day, and deprived of that moisture necessary to keep the fluids of a European in due dilution, its deficiency causes the bile and other secretions to become too thick and viscid. That for want of due aqueous dilution, its acrimony excites and stimulates the liver to those excessive secretions, which occur for want of such copious and bland commixture of moisture as takes place under a more uniformly humid and serene sky.

The man who dilutes his blood with simple diluents, escapes many of those hepatic and bowel complaints to which the drinker of spirits is liable. Nature seems to provide for the thinning of our fluids even with our food; for in hot and dry regions, she affords all her nourishing productions, made up as it were of water, or its elements. The fruits, roots, and plants of warm nations, are almost composed of water alone, combined with sugar, albumen, starch, mucilage, (or gum and milk,) and such other softening and relaxing aliments as immediately become liquid in the system, keeping the blood and juices cool and fluid.

We may offer a familiar example to illustrate the foregoing positions, regarding the dryness of heated air. The sun's beams, falling around a fire, hinder combustion. A vacuum is thus said to be formed, depriving the fire of a due proportion of air. But the formation of a vacuum, would be productive of a greater rush of air to fill the supposed void. The reason of the phenomenon appears to be, that the air, around the fire, is deprived, by the sun's rays, of the moisture which in combustion would have joined some of the new elements evolving during the burning, and, giving out its caloric of fluidity, would have added greatly to the heat. For I believe it is the fact, that dry or anhydrous air burns too fast, unless carried or presented to the burning bodies in conjunction with vapour of water. The smith occasionally augments the intensity of his fire, by sprinkling it with water.

Snails, chamelions, and spiders, can live on air alone; but that air must contain a common proportion of water as vapour: they will not subsist long on anhydrous air. The same may be said of beetles, toads, lizards, &c.

The harmattan wind, which sometimes blows on the west coast of Africa, and which is remarkable for its dryness, occasions very unpleasant sensations, and serious disorders.

The low temperature of the aged, is not because their circulation is languid, but because little solidification of new animal principles is required to combine with or enlarge their mass of body.

The reverse is the case: instead of depositing fresh organized increments, the old particles are dissolving and washing away.

Thus the bones of the old lose half their weight, as the late celebrated Dr. Monro long ago pointed out.

"Quæ crescunt, plurimum habent calidi innati: senibus autem paucus calor."*

Lavoisier and Seguin demonstrated, that, during digestion, a larger proportion of oxygen than usual is consumed. There is also much more watery vapour of the air inhaled and fixed, and, consequently, more caloric evolved. For a man's temperature will rise, after he has eaten a meal of food, much colder than he is himself. There is a very great influx of moisture required during mastication and digestion, to make up for the quantity of lymph that is expending by the salivary, mucus, lymphatic, pancreatic, and other glands.

These outlets are all discharging their contents, during digestion, to assimilate and eliminate the chyle, and render it liquid and easily permeable through the lacteals, and to serve as a liquid or fine vehicle, or serum, for the globules, fibrine, and crassamentum of the animalized chyle. When these fluid supplies enter the vena cava out of the thoracic duct, the blood gains its quantum of dilution, and we inhale less air and less oxygen, and, consequently, less aqueous vapour, it being then less required, than during the process of digestion.

These are the reasons why the celebrated diver, Mr. Spalding, consumed less oxygen in his bell, when he

* Hippocrates.

lived on vegetables and water, than on animal food; for by the former diet he moistened the blood, membranes, and fibres, with abundant liquid ingesta, requiring less absorption by the skin and lungs.

Having now treated of the agency of humidity, as well, in being the vehicle of useful, as sometimes of injurious communication, we conclude this topic with observing, that the medium of moisture is everywhere necessary. The immortal Davy could not rend the calcium from the lime, nor their basis from the other earths, until first being moistened they were brought under the indomitable power of electricity, conducted to the atoms through the medium of humidity.

The sounding lutes, or the early pipes of Pan, would render but discordant shrillness, unless they were previously wet, and then touched with the moistened lips. The valve of the air-pump must be soft, or it will badly fulfil its destined purpose. The valves of the heart must also be moist. This is no apology for the toper drinking exciting liquids. Use alcohol to moisten the valve of the air-pump, and it becomes corrugated and lost. Were those of the heart moistened with the same liquid, they would soon shrivel, and cease to move for ever.

> " —— Hominem cum vini vis penetravit
> Acris, et in venas discessit plurimus ardor
> Consequitur gravitas membrorum, præpediuntu
> Crura vaccillanti, tardescit lingua, madet mens,
> Nant oculi, clamor, singultus, jurgia gliscunt."*

In those shivering, cold fits, which precede fevers, &c., the inhalants are constricted as much as the exhalants, therefore, no cuticular absorption, and, consequently, no evolution of heat take place in the parts remote from the lungs. The extreme veins, then, become empty, as

* Lucret. 3, 475.

is proved by the shrinking of the surface; but when the spasm relaxes, these empty veins and absorbents suddenly imbibe humidity, and too copiously produce a great evolution of the latent heat.

This rapid rise of temperature excites the lungs and skin to discharge it. The pulse and action of the extreme arteries, and also the breathing, are increased in frequency and force: so soon as the overabundant heat is expelled by exhalation and perspiration, then, if perfectly driven off, the balance of temperature is restored; if not, there are repetitions of the same alternate processes, constituting diseases of longer continuance.

In all that has been said, the "ne quid nimis" is to be observed. Moderate humidity is useful; immoderate, nocuous.

CAP. VIII.

If the exudations, which moisten the serous and other cavities, pass out of the soft and tenuated membranous coats of arteries, in the state of vapour, and if this vapour be then condensed, to form the liquor of the cavities, is no caloric given out, or liberated, at the time of such condensation? If this constant source of heat be admitted, then we would know, why the brain contains so many sulci, with condensing membranes of immense extent, and circumvolutions, contrived to present extensive serous surfaces, to keep up and preserve uniform animal heat, to such a large mass of matter. We could then form some opinion of the heat supplied to the heart, by the lymph, condensing in the membranous cavity around it, in the pleura, in the peritoneum, the glands, joints, involucra, of muscles, and of every subdivision of muscular fibre. And we could reason how the animal heat is nearly as great in parts remote from the lungs, as in those that are convenient, and in the returned blood, as that just sent out.

The foetus in utero, can generate or evolve no animal heat, per se, yet its temperature is as warm as that of the uterus. It would be difficult to believe, that the lungs of the mother could support the heat of the child, so equal to her own, unless we admit that she inhales more vapour, during pregnancy, than at other times; which vapour condensing to form the liquor amnii, and other fluids connected with the foetus, and, forming part of its mass, gives out the caloric of vapour, during its condensation.

The learned Professor Jeffrey, of Glasgow, (an honour to his college and his country,) wrote an ingenious Thesis de Placenta, in which (page 41,) he demonstrates, that the blood, before reaching the placenta, is *venous* in the *arteries* of the chord, and that it is returned *arterial*, or *crimson*, in the *vein; hic*, vivide florebat, *ille*, nigricabat. Now, the opinion I hold, would in some measure account for this, by supposing that the water, and its portion of fixed air, which the blacker blood carried into the placenta, was there separated from it, as it is in the lungs, and remained in the liquor amnii, and that the blood, thus cleared of that water, would be then fit to nourish the foetus, and afterwards returned to the mother again.

Dr. Granville has communicated some curious facts, respecting the temperature of the uterine system during parturition; from which it appears, that it occasionally rises to 120°.* This could not be the case, if animal heat depended on that distributed from the lungs, as in man that temperature is never found above 109°, even in fevers.

That most excellent and judicious physician, Dr. M'-Donnell, of Belfast, finds that a pregnant female carbo-

* Phil. Trans. 1825. p. 262-3.

nates less, and a woman giving suck more, than at any other time.

Young animals, during the first few days after birth, disengage very little animal heat; probably because no assimilation, or new combination of materials, is yet uniting to form any part of the structure of the system; but so soon as the body begins to increase in weight, then it evolves heat; a certain number of atoms of vapour, or water, joining one atom of animal matter or principle, and the latent heat becoming free.

Oxygenized water, (the deutoxide of hydrogen of Thenard,) acts on metals and their oxides so rapidly, as to give out flame and intense heat. M. Thenard found that a little fresh fibrine decomposed oxygenized water. The tissues of the lungs, spleen, and kidneys, had the same effect. The skin and veins possess a similar property, but in a less degree.*

Foetal blood contains no fibrine.

At every inspiration, if the blood or lungs, have the power to attract the oxygen from the azote in the air, they may also have the power to separate the oxygen from the hydrogen in the water; and, at the moment of their nascent freedom, the great degree of compression then acting on them in the lungs, during inspiration, may cause these two gases, when forming water, or halitus, to evolve heat, of which they are well known to be the most active agents under other circumstances. Lavosier, to a certain degree, entertained this opinion. It should also be considered, whether the friction of surfaces, and the chemical changes going on, favour the probable operations of some obscure galvanic or electrical agencies, also tending to produce the mutual compositions and decompositions perpetually taking place.

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* Annales de Chemie et de Physique. Vol. X.

If the pressure of the atmosphere be increased, then the elasticity of the vapour will be partially overcome, and a portion of it will return to the liquid condition: and, conversely, if the pressure of the air be lessened, then liquids will assume the elastic form. One gallon of water, converted into steam, will heat six gallons up to 212°; or eighteen gallons up to 100° from 50°.

The heat of some cartilaginous fishes, is not more than that of the water they live in. They appropriate no vapour to their organization, and what water they assimilate, remains in their soft substances, in the semi-fluid state. Thus the little caloric which is evolved, is wasted by being given to the water around, being dissipated, as fast as formed.

Frogs and other animals inhale by the skin, in sand, when they cannot breathe by the natural air passages; or when these are sealed up with wax. Probably so do hibernating animals, in the torpid state.

In the germination of seeds, heat is evolved, but moisture is essential, and increases the size of the seed. Dr. Hales observed, that a plant, which weighed three pounds, gained three ounces after a heavy dew. I find, on trial, that four ounces of pease, when three days in water, weighed seven ounces.

Duhamel and Bonnet fed plants, in moss, with mere water. M. Tillet raised plants in powdered glass, by means of water alone. Dr. Hunter pointed out, that the temperature of the heart of a tree, is several degrees above that of the air of the atmosphere, if that air be under 56°; but if the weather be hot, then the heat of the interior of the tree is under that of the atmosphere. He also observed, that the sap which would freeze out of the tree at 32°, will not freeze in the tree, unless the cold is 15 degrees lower. Buffon states, that, in cold weather, the heat of vegetables becomes sensible, even to the touch. The mutations of fermentation proceed about the same heat as that of the animal temperature,—oxygen is absorbed, and carbonic acid given out,—heat is evolved, to which process moisture is essential.

Putrefaction resolves the solid and fluid matters into gaseous compounds, and vapours which escape, and an earthy residuum remains. It is said the atmospheric air aids putrefaction; and hence so many inventions for its exclusion from meat: but I think, if air were entirely deprived of *moisture*, no putrefaction would take place; and hence we dry meat, and fill it full of salts, sugar, spices, or substances that abstract the water. If we freeze the substance, it will not putrify in the air; because the water is then rendered solid, and unfit to produce the changes which putrefaction requires.

The mummy is rendered dry, and impervious to moisture, and then is preserved for ages. Spontaneous combustion cannot take place without humidity. The vegetable principles of hay join and solidify moisture. The caloric of fluidity becomes free; and, being confined, sets the heap on fire.

Dry air increases in volume $\frac{3}{8}$ for 180 degrees; and its progressive expansion is thought to be uniform by uniform increments of heat.

The ultimate constituents of vegetable matter are oxygen, hydrogen, and carbon; and in animal matter, azote. All the products of fermentation must be new compounds of these three or four ultimate constituents.

Sugar is a vegetable oxide, and consists of,

$$\begin{array}{lrl} \text{Hydrogen,} & 6\cdot\ 90 & \multirow{2}{*}{\Big\} \ 57\cdot\ 53 \text{ Water.}} \\ \text{Oxygen,} & 50\cdot\ 63 & \\ \text{Carbon,} & 42\cdot\ 47 & \ \ 42\cdot\ 47 \\ \hline & 100\cdot & \ \ 100\cdot \end{array}$$

Yeast disturbs the affinities of the elements of the sugar. It has a strong affinity for oxygen, which it takes from it; and the equilibrium being broken between the principles of the sugar, these so react on each other, as to be converted into alcohol and carbonic acid.

Fibrine consists of,

Carbon,	53· 360		
Azote,	19· 934		
Oxygen,	19· 685	22· 14	Water,
Hydrogen,	7· 021	4· 56	Hydrogen.

Vegetable gluten, though it be insoluble in water, imbibes it, and derives from it all its tenacity, elasticity, and adhesive qualities. If it be drawn out thin, and dried, it will preserve; if exposed to moisture and warmth, it will putrify like an animal substance.

Humidity is the medium of communicating oxygen to metals in rusting, as a mordant is of fixing a colour on threads or cloth.

How easily the balance of the elementary parts of our bodies may be disturbed, and the constituents changed, may be seen by considering how nearly their principles approach to those of each other.

Albumen consists of,

Carbon,	52· 883
Oxygen,	23· 872
Hydrogen,	7· 540
Azote or Nitrogen,	15· 705

Gelatine consists of,

Carbon,	47· 881
Oxygen,	27· 207
Hydrogen,	7· 914
Azote,	16· 998

Brain is composed of 80 parts water, and at least 10 parts more of the elements of water, oxygen and hydrogen.

It will be said we exhale much more water than we inhale. Sanctorius estimates the water conveyed out by the breath, daily, at half-a-pound; Hales, at twenty ounces; Menzies, six ounces; Abernethy, nine; Dr. Thompson, nineteen ounces;—but I have long thought, that a considerable part of this water was evaporated from the fauces, mouth, &c. I was led to this conclusion by noticing, that in the case of Lieutenant Hughes, whose trachea was penetrated with a stick, owing to his own imprudence, some years since, the air, rushing out, was not visible, in a foggy day, like the breath of others; and on exposing dry muriate of lime, to a current of the expired air from the wound, it took much longer time to become damp, than a similar quantity exposed to the breath, when the part was closed. This opinion is since confirmed by Magendie.*

If, with Jurine, Menzies, Monro, (tertius,) &c. &c., we estimate the volume of air inhaled at 40 cubic inches, each inspiration, and breathe twenty times in a minute, it will be manifest, that a man will respire 48,000 cubic inches in an hour, or 1152,000 in twenty-four hours; a volume of air, in the gross, equal to about eighty hogsheads.

In general, the atmosphere, at common pressure, and mean temperature, contains, in every eighty inches, about one and a half of vapour of water: that calculation would give three inches of the vapour, of mean density, for every four inspirations, so that the bulk of vapour of water, inhaled by the lungs of a man, of ordinary size, would be easily estimated; and *as readily* can we calculate the proportion of the *caloric of vapour*, set at liberty, when water is produced; and, *still more*, when a solid hydrate condenses from a cubic foot of vapour.

Some will say, that the more water or moisture we inhale, the more heat we produce: but I may as well retort, that the more oxygen we breathe, the more heat is set free. Whereas, Lavoisier, in his more matured experi-

* Memoir Sur la Transpiration Pulmonaire.

ments, proves, that neither the circulation, nor the temperature, were affected, by breathing in oxygen alone; and, in short, that no perceptible change was produced by it upon the animal.* It is not the *quantity* of food a man eats, that sustains him; it is only so much of it as the system requires, or takes, as nourishment. In like manner, it is not the *great quantity* of vapour, or water, which affords the caloric; but only so much of it as is solidified or assimilated.

The minute calculation of the liberated caloric, whether from inhaled vapour, and imbibed moisture, or derived from our food and drink, and which is set free by combination and consolidation, would require a longer dissertation. More space would also be requisite to compare the expenditure of the heat, exhaled by halitus, and emitted by various secretions, with the quantity taken in or evolved; but, for the purpose of argument, it may render the matter intelligible, if we may estimate the sources of the evolution of caloric of fluidity in our system, as 30; the sources of its expenditure, as 20; the difference as 10, for sustaining the regular healthy animal temperature, through all the wondrous discharge of our various functions, for ever changeable and changing.

> "Resolutaque tellus
> In liquidas rarescit aquas, tenuatus in auras
> Æraque humor abit. Dempto quoque pondere rursus
> In superos ær tenuissimus emicat ignis."†

CAP. IX.

HOWEVER various the effects of air and temperature on the living tissue, it would be foreign to my purpose to enter into lengthened remarks on the subject of respira-

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* Mem. Academ. Sciences. 1798. † Ovid, Met. 15.

tion, or the numerous views of those who regard oxygen as the source of animal temperature alone. I have already hazarded the opinion, that it is not altogether, and, probably, not at all, the source of our heat, except in so far as it is conducive towards bringing the blood, and other animal matters, to a condition fit for the mutual actions and reactions of the atoms upon each other, and in so far as it enters into a part of the energetic affinities of elementary organized matter itself. How much these affinities are modified by, and productive of heat, is a subject of curious inquiry, and deserving careful research. If any notions here ventured appear at first extravagant, or unsupported by reason or analogy, it should be considered, that they are candidly stated, more for the purpose of eliciting information, than the desire of advancing theories. Many hypotheses may be ventured, which it is yet difficult to prove. Newton did not conceal his opinion, that water contained a combustible body, though it then seemed paradoxical. Time has proved that his idea was correct.

Believing that the elements of which we are composed, are in a perpetual state of alteration, of composition, and decomposition, and that the greater part of animal heat, and its consequent agency on the living tissue, is caused by the reciprocal affinities and loves of the atoms, forming new particles, and these new particles distributing the heat arising from the altered condition of the ultimate elements composing them, and from the solidification of the vapour or water, necessary to the existence of new formed principle, as hydrates; and as this source of heat is equally active, whether the new formed hydrates combine with our solids or fluids, or pass away by some emunctory, after mutation, it need not be wondered at, if we venture to suppose, that as health consists in a just and natural proportion, not only of the ultimate elements, but also of the proximate principles, so disease depends on derangement and disproportion, in the quantity or combination of these elements. Numerous additional tables could easily be shown, exhibiting how readily the addition or abstraction of one or more atoms of the same elements would occasion evolutions of many organic combinations, different from those already existing, and how much the addition or diminution of moisture, *air*, and *temperature*, would accelerate or retard such reciprocal interchange of elective evolutions.

The breaking up of the due and healthy compounds, and the consequent formation of altered ones, would produce an altered state of the entire frame, or of a part, and constitute complaints, general or local. Thus if we suppose albumen to contain one equivalent of nitrogen, and that from some cause, a second equivalent of nitrogen be disposed to join the first, we then have the proportion of azote, existing in uric acid. If we follow this mutation of atomic interchange, we can conceive how the nine remaining equivalents of oxygen of this altered albumen, and the three of carbon, may join some other nascent compounds, together, or separately; one part joining to form carbonic acid, and another part uniting to gaseous elements, of some new evolving product.

In some such way we can conceive, how readily a particle of uric acid can be produced, not made up (de novo,) from the blood, but a new product, resulting from the decomposition of some broken down principle, previously existing in the system, or circulation. Is this the reason, that abundant evolutions of uric acid, and similar matters, succeed the too copious formations of fibrine in fevers, and inflammatory diseases, and in acute rheumatism, and gout? We see how urea is artificially obtained from cyanate of lead and muriate of ammonia. The cyanogen, containing nitrogen and carbon; and the ammonia nitrogen and hydrogen, all essential to the formation of urea.

Tannin, composed of carbon, oxygen, and hydrogen, can be formed by art, by contributing to carbon the other requisite elements, from the action of water and acids.

The letters which we read in the scale of music are few, and yet, by their different combinations, the varieties produced are extensible ad infinitum. In like manner, the number of the ultimate elements composing animal matter is small, but the resulting combinations varied and variable, without limit.

How readily albumen and fibrine are reciprocally convertible into each other may be imagined, when we reflect, that they only differ in composition by fibrine containing one proportional of carbon, one of hydrogen, and one of nitrogen, more, and one of oxygen less, than albumen is made up of; and hence we might suppose, (though ignorant of the remote causes of the change,) that in inflammatory diseases, the atoms are disposed to form fibrine in undue proportions; and, in dropsical cases, scurvy, and diseases of debility, a contrary affinity is exerted; and albumen and gelatine too copiously produced; and hence we would explain how venesection and antiphlogistic regimen diminishes the quantum of fibrine, and promotes the formation of softer principles of less tonicity and exciting powers. Hence we would reason on the modus operandi of various medicines, producing new chemical affinities of atoms, and moderating the attractions of those that combine or act with untoward energy.

It may be objected, that we would thus be led to the theories about the chemical origin of diseases, and again become Soladists or Humoralists; but I see no reason to dread this result, if it enable us to account for disorders, and symptoms, or disturbed affinities of matter, although we may not yet be able to ascertain the original or exciting cause of the undue preference and attractions of these elective alterations constituting complaints.

Many truths have been established, the investigations of which derived their first deductions and elucidations from analogy; and we draw examples from the vegetable world to explain the nature of the animal agencies. Thus the proximate principles of sugar, starch, gum, &c. composed of carbon, oxygen, and hydrogen, are convertible into each other by relative increase or diminutions of their ultimate elements; and, like the constitution of animal matter, that of vegetables is controlled by the changes and reactions of these organic agents, acted on by temperature, air, and humidity.

Thus it is known, that if a vegetable contain more oxygen than is equivalent to convert its hydrogen into water, that vegetable substance will be acid, and its organization and other properties will vary as the elements are diversified in their combinations and proportionals.

The influence of temperature on the vegetable kingdom is unbounded: germination cannot take place at 32°,—probably one reason of which is, that the water, so essential to the new combinations which germination requires, cannot exert its potency, being in a solid or frozen state. The action of air is also essential. Ray, Boyle, and Boerhave, long ago showed this; and Scheele and Achard demonstrated the necessity of oxygen to the process of germination, for seeds buried deep in the earth do not grow. Humboldt pointed out that chlorine, from its power of decomposing water, and setting oxygen free, promotes vegetation. Without a certain degree of heat, animal or vegetable life would not commence or continue. When vernal warmth begins to reanimate nature, the seed bursts the boundaries which enclosed it, the buds dilate, the leaves expand, the flowers spread, and fruits become matured.

"Jam violas peurique legunt, hilaresque puellæ,
Rustica quas nullo tera serente gerit,
Prataque pubescunt variorum flore colorum,
Indocilique loquax gutture vernit avis;
Herbaque, quæ latuit Cerealibus obruta sulcis,
Exerit è tepidâ molle cacumen humor
Quoque loco est vitis, de palmite gemma movetur:
Ludit et in pratis, luxuriatque pecus."*

When the seasons decline in temperature, then the plants, and their parts, again become torpid. Inorganic bodies grow, but their growth produces no evolution of heat in the mass; but organic materials assimilate to themselves new and intimate combinations, pervading and penetrating the inmost recesses and particles, without, as well as within; and in animals, each development dispersing through the mass such degrees of natural warmth, as every renovation and deposition is calculated to evolve. Nor can we expect the same sources of diffused heat, in vegetable life and growth: their simple solids are greater than those of animals. The latter are composed of at least nine parts in ten of liquids; whilst the former are made up of less than a half: a tree, for instance, is in a great measure solid wood, dry and permanent for ages; whilst the animal, on the extinction of life, soon resolves into juices, leaving nothing but a small residuum of kindred dust.

Add to this, that carbon, of which the mass of vegetables is made up, and which gives permanency to the oak, can imbibe, and retain, or join with a great quantity of moisture, without any true solidification of the fluid, or evolution of heat. It can take and retain water, (quasi water,) as a sponge does; whereas azote, which predominates as an ultimate principle of animals, being (per se,) a gas, must, in its organized fixation, exist in such

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* Ovid. Tr. 3, 12, 5.

a state of chemical combination, as insures the distribution of caloric, which every gas gives out, when condensed into a solid or fluid state of union, with other atoms of various kinds.

On repeating experiments, similar to those made by Priestly, Hunter, Goodwin, and Ellis, showing how the colour of the blood is reddened through membranes, I am led to suspect, that what they considered an absorption of oxygen from the air of the jar in which the bladder of blood was suspended, and a consequent rise of the mercury to supply its place, arose from an exhalation of water, and the fixed air it contained from the blood, and a consequent diminution of the bladder, and a proportionate rise of the mercury in the jar. Milk, or serum, do not hinder the changes to take place on the surface of blood, because they permit the water and carbonic acid to leave it; but a stratum of water still keeps the blood as black as ever.

We know that a bladder of dilute spirits will give out its water, though held by strong affinity, and the alcohol will be left: the air has a stronger affinity for water, than either alcohol or blood has, and of course will take it from either of these fluids. The abstraction of the water, and its fixed air, from the blood, is one of the reasons why its surface becomes red, for I have already hinted, that venous blood is blacker than arterial, because it contains more water, and a quantity of fixed air. And hence the dark colour, and not owing to carbon, which is not (quasi carbon,) black; the diamond is transparent, because its aggregation is different.

I think it very unsatisfactory what Richerand declares, —that arterial blood is crimson, because it has joined oxygen, and venous, black, because the same air has joined carbon.*

* Richerand, fourth edition, p. 212.

It is said by Hassanfratz, that arterial blood will become venous, in glass tubes, hermetically sealed; so that when it becomes purple, when excluded from air and moisture, it would seem to have contained the principle which darkened it; but let it be observed, that it might have attracted as much moisture on entering the tube, as would colour it, when the chemical changes would have time to advance, and its state of aggregation to become altered.

The pulmonary arteries, which expose venous blood, give out water, charged with fixed air, and excrementitious halitus, gases, or impurities, which that water washes out of the blood, and as a certain proportion of their contents is given out by the pulmonary vessels, as water, hence the systemic arterial blood contains less serum than venous, in the same ratio.

As the water taken in by the veins, is not generally acted on, or consolidated by the other constituent elements, contained in the venous blood, until being exposed to the air in the lungs, they obtain their proper proportionals of oxygen, then the chemical unions begin to take place. The hydrates are formed, and continue forming, along the arterial course; and it is only then, that the caloric of the water is more freely and suddenly set at liberty, at the moment the nascent elements, formed by the water, the oxygen, and the animalized elements of chyle, &c., unite, and hence the superior heat of arterial blood. For besides what the pulmonary arteries give out in the lungs, the systemic arteries are giving out lymph, or serum, along their whole course, and also water in shape of vapour; and, when it is condensed, it is returned along the lymphatics, to thin the blood, and diminish its viscidity, when just entering, and about to pervade the minute radicles of the pulmonary arteries; and it is there, in a great part, that the superfluous water is expelled, and room made for the influx of new supplies, from the veins and atmosphere, to mix with the blood, in place of that exhausted and exhaled, for it is the exhausted lymph that is discharged at the lungs or in excretions, it being no longer fit to form nutrient combinations; and it is therefore sent to a set of extra aqueducts, called lymphatics, to carry the waste liquor away. It is thus that the condensed lymph of the cavities is conducted off, in a great measure, after its formation, to give room for new moisture to form, and, of course, to obtain the newly evolved heat the water gives out, when condensing in every cavity.

Long since this was written, I have seen a paper by Dr. Williams, (2d vol. Trans. Medico Chir. Soc. Edin.) in which he describes an experiment, calculated to show, that fixed air leaves the blood, in cases such as those related by Priestly, &c. He states that the air in the jar suffered no sensible change of bulk. He adds a circumstance very confirmatory of my opinion, that water escapes, "but much moisture has been deposited on the sides of the jar, and a considerable quantity of serum had transuded through the bladder." Dr. Williams does not deduce any inference from this circumstance; but he clearly shows that the change on the blood, was not owing to any action of the bladder itself, as Mr. Ellis had supposed.

According to Despretz, the theory of Dr. Crawford would account for only sixty per cent of the animal heat: he leaves the other forty unaccounted for.

There is not much absorption of azote during respiration; first, because that gas is not soluble in the mucus, water, vapour, or animal fluids, as oxygen is; and because, when the principles in which it exists, change, in our system, the azote does not leave the body, having no other atoms to join, as the carbon and oxygen have, but remains, to enter into the conformation of the new structure, which replaces the old. Whilst, on the contrary, part of the the former oxygen joins the hydrogen, to form water, and a part unites to carbon, to make fixed air, both to be driven off, and of course a continued new supply to be as perpetually required from the atmosphere, and the ingesta.

From the few observations hazarded in this essay, on the origin and influence of animal heat, and from the many inferences connected with them, I offer the following deductions as a *recapitulation*, in an unconnected series, rather as *queries for information*, than *suggestions for adoption.*

That we find animal heat at a very high degree, in hectic cases, where the lungs are wasted away, or where they are consolidated by hepatization, and impervious to the air. Hurnius has observed the lungs of a printer, exposed to the vapour of lead, so withered and useless, as to resemble a shrivelled apple. Bonet, *Sepulch. Lib.* x. *Sect.* 1, *Obs.* 45, describes the lungs, in some cases, as perfectly dried up.

That animals who have breathed hydrogen, or even azote, some minutes, emit much more carbonic acid, than could have been previously confined in the membranes or cells of the lungs, and this carbonic acid could not be composed according to the commonly received theory of respiration.

That high local heat may take place in parts distant from the lungs, not occasioned immediately by oxygen or breathing.

That those who attribute every change to the influence of "*vital action*," will feel less prejudiced against the power and operation of chemical laws, when they consider, that if artificial respiration be carried on after death, the phenomena of arterialization will proceed as in a living body, carbonic acid will be evolved, and the blood will be *crimsoned;* but they will wait in vain for the production of that heat, so abundantly attributed to the same process in the living animal, because, in the dead, there is then no conformation of new parts, or consolidation of fluids, nor any regular waste of the old.

That there must be another great error in estimating that 11 ounces of carbon, are given off from the lungs in twenty-four hours. How is this reconcileable with the fact, that a man will lie many weeks, his animal heat intense, breathing quick, expending carbonic acid rapidly, and taking in no carbon, at least not in food.

One remarkable proof that the water, either inhaled by the lungs, imbibed by the skin, taken into the stomach by the mouth, or formed by the junction of its elements in the frame, disengages and distributes caloric, is this, that in cases of *catalepsy,* and some kinds of hysteria, there is a *long continued icy coldness,* though respiration goes on without obstruction, and, in such cases, the urine is found to consist of water almost unchanged, in copious quantities, and without colour, smell, or any of the constituents of healthy urine. During the fit, no assimilation takes place, and the water is excreted in the liquid state.

Further, Mr. Brodie proved, that, in certain conditions of the system, when the nervous influence is destroyed, "artificial respiration cannot, in any degree, preserve the heat of the body, although the air respired sustains the same changes as in natural respiration; and, moreover, that in these cases the secretion of urine is suppressed."* Mr. Brodie, of course, attributes this want of heat to the nervous agency being cut off, by decapitating, or poison-

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* Phil. Trans. 1811, 1812.

ing the animals under experiment; but the cold is occasioned by the cessation of the formation of new elementary matter, and reduction of old, and a consequent non-formation of hydrates of new principles, and non-evolution of their elementary heat; there is at the same time a cessation of all the secretions, and for the same reasons. So that the heat does not cease directly, because the nerves are injured, but because their injury places the system in a condition unfit to carry on its changes and evolutions of healthy warmth. Where there is not a total nervous shock and destruction, animal heat will at least partially proceed. Any parts capable of secretion will be able to evolve heat.

Secretion proceeds in paralytic limbs, so does heat, much more than the patient's feelings would lead him to suppose.

Add to this, that we have no proof how the venous blood acquires a superfluous quantity of carbon, as Black, Priestly, and Lavoisier maintained; nor of the capability of carbon being secreted or evaporated, as Mr. Ellis supposed.

That, in numerous experiments, I find the arterial blood, when reduced, contains as much carbon as the venous.

That, in my opinion, all the water inhaled, either by skin or lungs, as vapour, or separated from food and drink, contains a portion of carbonic acid, which water readily takes up, particularly if subjected to pressure, or agitation in the cavities or vessels.

That, when water is joined to other constituents, forming hydrates, the carbonic acid it may have held, as well as its heat, are set at liberty.

That, so much of this vapour, as is thrown out in cavities or membranes, when absorbed, takes up and conveys the fixed air into the thoracic duct, and lungs, and that it is not carbon we have to deal with, but carbonic acid, already formed. Sir E. Home and Dr. Scudamore, thought that the carbonic acid was in the blood. I think it is *in the water* of *that*, as well as of the other fluids.

That, for this reason, the oxygen taken up by the lungs, is not consumed in joining carbon, but that, as before stated, it enters the blood combined with water, and circulates along with it, fitting the blood for all the myriad changes into which it enters, and of which the oxygen forms a part, as certain, and more immediately necessary than those contributed by the food we eat, or the drink we consume.

That it is surely more natural to imagine, the oxygen and carbon constituting the first, molecules should, on their dissolution, escape in junction, as carbonic acid, than to conceive, that the carbon floats, like charcoal, out of the blood, and enters into a combustion with oxygen from the air, under circumstances incompatible with their union, *either* in the circulation, or out of it, in the air vessels.

When the old particles are in progress of dissolution, the oxygen and hydrogen composing them do not flow through the veins and ramifications, disjoined and separated, but kindly circulate along as water; and in this very water, as well as the lymph, the fixed air also makes its way, until it escape at the mouth and skin.

An animal bathed in lime-water, will be seen to exhale fixed air by the skin. Millet, Lavoisier, Cruickshanks, and Jurine, agree with the idea that carbonic acid is expelled by this surface.

That, in the reductions so taking place, when complex animal principles are resolving into simpler chemical unions, heat may be also evolved, as Dr. Thompson pointed out in his System of Chemistry, p. 407, 412, &c.

Therefore, as I endeavoured to show, heat is disengaged from vapour of water, or any other æriform matter, at the moment of its fixation in our system, and as the quantity of caloric so set free, must greatly exceed any loss of heat that could take place when these principles passed away in the fluid state, the balance gained would be greatly preponderating; so that if we take into account any possible addition, from the change of more complicated into simpler elements, then the process of breathing would be absolutely a cooling one, and respiration not a heating operation; but from the quantity of cool air taken in, and warm water emitted, breathing would be admirably adapted for refrigeration. This was the prevalent opinion for many ages, from the recent times of Morozzo, back to the days of Haller, Boyle, Descartes, Swammerdam, Harvey, Bartholine, and Fabricius.

Boyle remarks, that "divers of the new philosophers, Cartesians, and others, think the chief, if not the sole use of respiration, to be the cooling and tempering of the heat in the heart and blood, which would otherwise be immoderate."

For these and many other reasons, we may infer, that the tendency of the ultimate elements of our system to join under new forms and combinations, and in each case to solidify water, will be found a more probable source of the greater part of animal heat, than the consumption of oxygen in the lungs, or the different capacities for heat of arterial and venous blood.

Numerous examples could be adduced, to show that caloric must be generated in some way different from that said to be produced by respiration. Persons have been known to drink ten gallons of cold water during a day, which was soon raised to their own temperature, a difference of forty or fifty degrees. Dr. Good says, four hundred pints of wine and water have, in some cases, been swallowed daily. In many instances and avocations, the expenditure of caloric is greater than the more common theories would account for.

1st.—The dark colour of the venous blood, is said to be owing to carbon; but if we add a small portion of water to arterial blood, we give it the black colour, and all the character of venous blood; so that this colour may be owing to a difference of *aggregation* and *fluidity*, and consequent alteration in reflecting the colorific rays. The arterial blood parts with its water, during its course through the system, the venous acquires water, and hence the difference in the temperature, and other qualities.

2d.—That as fibrine is double as much in the arteries as in the veins,* it may be observed, that where that principle, or its formation, most prevails, there heat is greatest; and as every atom of fibrine consolidates or combines with a certain number of atoms of water, the latent heat of such atoms is set free; for as each substance has a specific caloric peculiar to itself, every change of composition will be attended with a corresponding change of capacity for heat, of course the new hydrate retains less heat than it did in the state of water. The increase of density in hydrates is often very great, and much caloric is evolved when forming,—thus hydrate of lime is specifically heavier than pure lime.†

3d.—That as fibrine is forming in the chyle, arterial blood, and other parts, the evolution of heat accompanies its formation from its source, whether it join with our mass of flesh, or float in our circulations.

4th.—That if this notion be correct, with regard to hydrate of fibrine, it also applies to the other proximate principles, such as hydrate of solid albumen, gelatine, lime, urea, &c. &c. That as the quantity of water taken in, both in food and drink, and during respiration, is great, and the constant formation of new animal particles very considerable, so is the continued production of heat.

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* Myer. † See Thompson's Dispensatory, p. 54.

Part of this heat is expended in converting some of the aqueous portion of the blood into vapour; this vapour passes easily into all serous cavities, pervading the moist, warm, arterial tunics, and serous membranes: this vapour gives out heat on the surfaces of the cavities, and the water condenses like dew.

5th.—In this way, colourless parts, having little activity of circulation, and no red blood, are preserved warm, and of uniform temperature and moisture; for if the blood carried the heat ready formed from the lungs, the largest trunks would be much warmer than the neighbouring parts.

6th.—However humble the comparison, the lymphatics which take up this water, and carry it to the thoracic duct, perform the function of waste pipes in a building, conducting away the water which has condensed in warming the apartments with its vapour; this hinders its collection in the cavities, and carries it back, where it meets the venous blood at the moment of entering the lungs, and causing it to pass more permeably through the capillaries.

If the formation of some of our fluids into vapour, can enable us to be cooled to 109°, when the air of an oven around us is at 300°, will not the inverse ratio hold, when we are as low as zero? The conversion of vapour into solid hydrate, or even water, will give us heat, as the former process took it away.

7th.—The excessive rise of temperature sometimes felt, either local or general, is owing to the inordinate or undue energetic affinities of some of our ultimate elements, joining and forming new proximate principles in irregular or unequal proportions, or altering those already formed.

8th.—Another cause of great heat may be owing to some injury, or unusual state of the nerves or fibres, rendering the membranes more dense, constricted, or less permeable, thus hindering the due escape of vapour from the blood, and causing the accumulation of heat in the circulation. On drawing blood, the escape of this vapour in the air is most dense and rapid where the blood is hottest.

9th.—Where the vapour in the blood is hindered from pervading the tunics into all cavities alike, there will be irregular heat and cold; and hence the feeling of cold in some internal part, when the skin is burning hot. Here it may be observed, that it is probable Delaroche and Berard have computed the specific heat of aqueous vapour too low, whilst Dr. Crawford estimated it too high.

10th.—That local heat, in inflammations, might be accounted for, in a great measure, from hurts, pressure, or applications, causing a disposition or facility for new atomic combinations, which increase the bulk and secretion of such parts, and produce new depositions and organizations of animal matter. Blisters, and other applications, induce new actions, an increased formation of lymph, and local heat. The exhibition of mercury augments the formation of fibrine, till the gums are rendered scorbutic, after which it diminishes it rapidly: in the first stage, heat is produced; in the second, cold.

11th.—It may be said that, connected with inflammation, is over-generation of fibrine, and consequent consolidation of water and rise of temperature, increase of bulk, desire for drink, undue secretion of lymph, and, at length, by change of atomic elements, pus forms and shiverings ensue; or, if the elements change too rapidly, and untoward mutations are suddenly formed, disorganization follows such derangement, in the same way as takes place from severe burns or caustic applications.

12th.—Though no person will deny the agency of the nerves, I think it will be admitted, that their healthy action aids in the regular distribution of animal heat, through their influence in enabling the vessels to perform their functions, but do not enter as direct agents into the production of it. It is by producing a proper balance and calibre of the vascular action and vessels in a paralytic limb, that the nerves are irritated by eschars, and thus indirectly tend to reproduce that state of the circulation in it, which restores the proper heat. Hunter states, that the power of producing animal heat does not "depend upon the nervous system, for it is found in animals that have no brain or nerves."*

13th.—Did time permit, it would be easy to calculate the quantity of water formed from the vapour of water in the air, at the common density, by calculating that one cubic inch of vapour taken in with each inspiration, and twenty respirations in a minute, would give a volume of 28,800 cubic inches in 24 hours, each containing its definite quantity of water; just as one can easily estimate how many gallons of water he can raise from 50° to 100°, by the heat obtained from mixing a certain weight of water with vitriol or lime. Thus one pound of water will raise four pounds of sulphuric acid to 300 degrees, and more.—Besides, a quantity equal to nine-tenths of our food and drink is water; and every atom of it, consolidated into animal material, gives out its proper proportion of heat.

That, lest misconception might arise concerning the part of these ideas relating to nutrition, it should be understood, that such changes of elements as produce new compounds which evolve heat from their altered capacities, or from combining with and solidifying water, are a source of communicating animal caloric to the circulation and frame, equally as if a particle of new bone or

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* On the Blood, p. 103-4.

muscle were formed and added to the general mass, and hence heat will be copiously evolved in the hectic declining victim of phthisis and fever. For, if the formation of fibrine be a source of heat, it is equally so, whether joining the solid material of our system, or floating in our blood.

That if we estimate the mass of the animal system at nine parts of water in ten of that mass, we may reasonably infer, that in the formation of animal hydrates, one atom of the proximate principle will join with nine of water.

That if these nine atoms of water be taken from the *vapour* imbibed, then the evolution of caloric will be greater than if derived from the aqueous parts of food and drink, and this probably might aid in accounting for the higher temperature of birds. Hunter, in his essay on the air-cells, in birds, judiciously remarks: "I can hardly think that any air which gets beyond the vesiculated lungs themselves, is capable of affecting the blood of the animal, as the other cavities into which it enters, whether of the soft parts, or the bones, appear to be very little vascular."

That it is not by the quantity of food or drink taken, or vapour imbibed, either by skin or lungs, that we calculate the quantity of heat, but from such proportion of that moisture, as enters into new chemical hydrates, for some cold-blooded animals are very voracious; but little or no hydrates are compounded except in red blood, and it is one great use of the oxygen in the lungs, to keep the blood in a condition to form those combinations of which oxygen itself is a principal component part.

WHETHER we attribute the evolution and uniform preservation of regular animal heat to the junction of oxygen and carbon in the circulation, with *Crawford*, and most of the enlightened modern physiologists,—to the meeting and action of these gases in the lungs, with *Dr. Black* and *Lavoisier*,—to the production of heat from food, during nutrition, with *Descartes*, *Franklin*, *Rigby*, and even *Hunter*,—to galvanism and nervous influence, with *Philips*, *Brodie*, and many others,—or to the liberation of 1000 proportionals of heat from the solidification of vapour, when condensing to form hydrates in our solids or fluids, as I have ventured to set forth,—whatever be the source, or means which regulate our temperature, whether any, or none of these, or all of them combined, we should remember, that the end of our speculations should be, to ascertain the causes of *altered conditions*, and *consequent disorders;* and our next aim to keep in view, the great object of arriving at some rational means of *altering*, *alleviating*, or *removing* the *untoward changes*, which have occurred in disease, and superinducing the former healthy state, or one as near as possible approximating to that of natural salubrity, or healthy disposition.

CAP. X.

The subject of atomic changes produced on the human body, so far as they regard the modus operandi of medicine, would lead to tedious disquisitions, altogether foreign to the objects of this paper. Such investigations are more suitable to the attention of some chemical philosopher, uniting extended opportunity with unremitting industry. It is clear that the mode of action of medicine might be more satisfactorily explained, by referring their effects to an altered condition produced in our component elements, than by resting satisfied with the theory advanced and maintained by Dr. Cullen, and those who preceded him. They attributed the activity of remedies to their *impulse* on the extremities of the nerves, which impulse produced a *motion*, propelled along the course of the *nerves* to their source, and thence arose a *sensation*, which again caused a *volition*, "whereby a motion is produced, which being determined along the course of the nerves, into certain muscles, or moving fibres, the action of these, as well as the various effects which their action is said to occasion, are in consequence produced."* This curious semi-electrical philosophy, like the *phlogiston* of the old school, mystified what was before abundantly obscure. Without attempting to elucidate the modifications which regulate and influence the different temperaments, or explaining how the state of the

* Cullen, Mat. Med.

solids is more rigid in one than another, and how their more loose or cohesive conformation depends on certain dispositions of the atomic structure, I will merely observe, that as disease depends on derangement of organic principles, so the rigidity, firmness, and elasticity of our fibres, or the weakness, relaxation, and softness of their tone, depend in a great measure on their constitution, and relative proportion of atomic elements, influenced like those of vegetables, by variations of air, aliment, and temperature.

No doubt, the topic about to be introduced, illustrative of the tense and altered tone and condition of fibre, from various causes, will appear extraneous, and even indelicate to some; yet as the subject is intimately connected with one of the most interesting inquiries which can engage the human mind, and relates to the relief of the most amiable of created beings, it will be granted, that we may as well refer, in our examples of particular states of aggregation of the solids, to the altered tone of female fibre, as to that of any other animal tissue.

They who are aware how great a change can be effected on the muscular cohesion of man, and other animals, by *training*, will admit, that, during this invigorating process, a great portion of fluid particles are dissipated from the system by perspiration and otherwise, and more solid ones added by appropriate regimen; hence a more firm and rigid contexture is established, in place of the softer and yielding organization, previously existing. There are twenty-three pairs of muscles directly concerned in singing. The boy of twelve years old will chaunt most "eloquent music;" but, at fourteen, his silvery pipe becomes hoarse, stridulous, and rigid. Why? Because new atomic changes have been induced, — the soothing moisture of the minute tissues, of the vocal organs, being suddenly determined away to supply other textures of the body. How much the tissues are liable to become more tense, or more relaxed by circumstances, may be conceived from the effect which the slightest alteration of air, damp, age, diet, or any other causes operating on the organs of the voice, continually exert. In like manner, other parts will be more contracted, or yield more easily, according to the tense, or softer state of the *simple solids*. That these conditions are in a great measure hereditary, may be admitted, when we observe, how much the voice of the offspring resembles that of the parent at certain ages. Dodart declares, that a variation in the capacity of the glottis, not exceeding the fifty-fourth part of a silk worm's thread, or the three hundred and fifty-fourth part of a hair, will occasion a difference of tone.

It will be asked how it happens, that if sudden vicissitudes of temperature, damp, unsuitable regimen, and dress, cause an altered contexture of the fibres of the mother, that these results can extend to the offspring, and entail a hereditary condition of parts, such as those deviations from nature are known originally to produce. It may be answered, from the analogy of a thousand other altered structures, animal and vegetable, that this conformation, at first nearly accidental, may in time become fixed, and permanently descend from parent to child. In uncivilized nations, where labours are easy, there are few artificial alterations of sudden heat and cold from rapid change of dress, diet, ceremony, or habit of life. Nature's laws are nearly uniform and the same; but where the reverse occurs, and an unnatural tonicity, hardness, or constriction of a particular muscular sphincter, or other tissue, is permanently established, it is just as probable that the same organization may descend to the offspring, as that the black should entail her ebony dye upon her young; the scrophulous parent, scrophula; or that the hue of the hair and eyes, and the shape of the head, nose, joints, and general configuration, and the temper and tone, should exactly resemble those of the mother, in all the alliterative qualifications of colour, consistence, conduct and constitution. Of course, this opinion of hereditary density and elasticity of tissue, will be taken with all the exceptions to which we see it subject every day.

Some further observations, confirmatory of the above interesting topic, are annexed at the end of this little volume. The subject being more peculiarly adapted to a particular department of our profession, than to this general dissertation, is submitted as an APPENDIX. Being designed for the student of the *obstetric art*, it is hoped it may direct his attention to the all-controlling example and agency of nature.*

Having attempted to direct more attention to the influence of TEMPERATURE and MOISTURE on the solids, I shall next say a few words of their effects on the FLUIDS of the body, preparatory to the practical considerations of *heat* and *humidity*, as contributed by immersion in baths, and application of vapours.

The old notion of a state of spissitude, or lentor of the blood, was long accounted a cause of many diseases, local complaints, and obstructions. Though this theory of preternatural thickness has been long supposed hypothetical, and an improbable supposition, yet it may be found, that a certain decrease of temperature of a part, or the whole, an obstruction to imbibition of a due supply of aqueous commixture, or its casual and inordinate abstraction from the circulating mass, by absorption, or

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* See Appendix, page I.

otherwise, may diminish the quantity of watery liquid diffused in the blood, and tend to induce a condition of that fluid, more apt to pass from albumen to gluten, and from gluten to fibrine. Probably, if a healthy standard of comparison could be established, it might appear that one person's blood would be really more viscid than that of another.

If this idea be still admissible, then we could judge how appropriate would be the dilution of the circulating mass, by large supplies of liquid, and the propriety, in local affections, of applying warm, soothing fomentations, calculated to enlarge the diameter of the capillary vessels, and to soften the aggregation of the parts containing and contained.

The degree of fluidity of the blood itself, bears a relation to its warmth. I often noticed, that where the blood springs out very liquid, the heat was greater than where the jet was dark and more glutinous. Whether this be owing to the more plentiful assimilation of aqueous proportions in the one case than in the other, I cannot pretend to say; nor can I yet conclude whether blood so constituted, be found warmer, or not. We observe, in fatal cases, that after exposure to deleterious gases, which kill *negatively*, by depriving the lungs of the influx of pure air, the blood often remains fluid, the limbs retain their pliancy, and the whole body, solids and liquids, the natural animal heat, or even an increase of it, as I have seen, several hours after death. In one case, so great was the warmth of the skin, that the friends of the deceased insisted life was not extinct, during an entire day; and though the lungs received no air, and, consequently, emitted no caloric, I was tempted to conclude that moisture had been imbibing by the surface, for the extremities kept up the heat as long as the centre, considering their relative mass of matter, and there was evidently a plethora of blood in the veins, which was neither viscid nor coagulated. The arteries were empty.

On the contrary, we see, how such gases as kill, *positively*, by their poisonous qualities, on the lungs and tissues, such as sulphuretted or phosphuretted hydrogen, instantly subject the whole system to such an altered condition, as unfits it for retaining or promoting natural temperature, and the blood at once becomes clotted and cold. I do not say, however, that, after death from asphyxia, the cutaneous absorbents, or those of the mouth, nose, or other surfaces, can or do imbibe moisture, or vapour, to make up for the cessation of the pulmonary functions, but I am more inclined to that opinion than the reverse. When sudden death takes place, and there is not such immediate destruction of parts, as after deleterious and active poison is inhaled, there may remain, some time, a latent and slight sensibility, endowing them with the power of some contractility. Magendie thought he observed a capillary attraction going on after death.

Whatever prejudices may have opposed the study of Humoral doctrines, yet we might indulge a hope, that owing to the rapid career of chemical discoveries, and the minute and accurate manner in which that amazing science is taught by a *Hope*, a *Thompson*, a *Barker*, and a *Turner*, that some of the youth, who profit by their prelections, will form associations, assigning to each individual some department of the investigation of the blood, and other animal fluids, and to their comparative state in health and disease.

Minute and long continued attention to this important subject, might enable a number of talented men to collect documents and discoveries, from which a *scale* or *table* might be contrived, calculated to show the minute alterations,—relative proportions of constituent principles, —different specific gravity,—temperature,—greater or less quantity of coagulum and serum, — difference of taste, — smell, — colour, — consistence, — comparative weight or volume of water,—soda,—potass,—phosphates,—fibrine,—albumen,—*colouring matter,*—and perhaps sulphur, and iron,—and again of ultimate elements, in the blood, according as it is found affected in particular diseases, and in various forms and periods of them; and also, as it is influenced by remedial measures, and its healthy constitution restored or retarded by the mediation of art. If ever these desirable objects shall be attained, and distinctions established, then our system of Nosology will be greatly improved.

I have often noticed, after venesection, that the blood of persons who were subject to enlargement of the tonsils and visceral obstructions, was much blacker than that of others, and, as far as I could judge by experiments, contained more carbon and carbonic acid. A society of judicious medical and chemical inquirers, would best manage these delicate investigations, noting all their observations of the exact analysis of the blood, in each complaint, and degree or period of it, and then comparing the results of numerous observations, separately made, on a large and extended scale, describing such easier modes of conducting the experiments, as attention and ingenuity would enable them to point out. Much practical information would certainly be derived during the progress of their operations.

Deyeux and Parmentier observed nothing remarkable in the blood of persons labouring under sea scurvy, except a peculiar smell, and an indisposition in the albumen to coagulate.

Dr. Wollaston could not find sugar in the serum of diabetic patients' blood. On one occasion, I found the water, which washed the coagulum of diabetic blood, sweet. I noticed, in the case of Captain ———, who was shipwrecked last winter on the coast of Sweden, underwent great fatigue, suffered intense cold, laboured long under severe pains, and stiffness, particularly of the sides, loins, and feet, that his blood was thick, viscid, and black. After a long course of diaphoretic medicines, and ten warm baths, at intervals, the pains, stiffness, and general illness remained; and though the pulse was not then strong, I tried the effects of drawing twenty ounces of blood. Finding it black, and that relief followed its abstraction, I repeated the venesection, and though the blood still continued like molasses, yet on bleeding him freely three times more, during ten days, he recovered in a great degree, without any medicine. The appetite was good all the time, though he formerly had stomach complaints occasionally, and from pain of the right side and epigastrium, was suspicious that his liver had been affected, and did not properly perform its functions. After the venesection, the warm bath then produced good effects.

Venesection empties the large vessels near the heart, but they soon refill with lymph taken from the extremities, these again with water, so that bleeding is in fact a dilution of the sangniferous system. If from twenty-eight pounds of blood, in a man, you abstract twenty-eight ounces, you add that proportion of water to the remainder. It is probable that this is partly the cause of those dropsies which succeed great and wasting hemorrhages. The veins, like nature, "abhor a vacuum." If not filled with blood, they will replenish themselves with lymph.

A first bleeding will generally show more crassamentum than a second, a second than a third, and so on, owing, as Dr. John Davy thinks, to the absorption of water into the blood from the capillaries, which empty their lymph into the red vessels.

I have long thought, that the fixation of the colouring matter of the blood on some texture, such as linen, silk, or cotton, by means of mordants, will yet enable us to arrive at some more certain means of discerning the difference of the quantity, shade, and adhesive properties of it, and its alteration by difference of health, and influence of medical agents. I instituted, some years since, a long continued series of experiments, on the tinge fixed on feathers, and muslin, by blood of persons in a sound state, and again in various diseases. Like many others, I thought I had sometimes made great discoveries; but again, my conclusions were not borne out by further trials, so that the joint efforts of numbers will be requisite to establish any certain data or distinctions, in observing the intensity of the colour of various persons' blood, in various periods, and in different conditions of that fluid. Mr. Brande more lately began some valuable experiments on this subject, and found certain salts of mercury, the best mordants, for fixing the hue of the blood.

It would be quite foreign to the purpose of this treatise to extend the observations on the constitution of the blood, and its different states, more than merely to refer to a few remarks from authors who have turned their attention to that most interesting topic.

Dr. Wells thinks, the more purple colour of the venous blood, is owing to its admitting the light deeper, and, therefore, that a greater number of particles reflect the light than in the same quantity of arterial blood.* If this be the case, it may probably be owing to the venous blood being thinner.

Dr. Schneider states, what I have often observed, that the colouring matter separates faster from the globules, in inflammatory diseases, than in others.† This must in part depend on the altered volume, or properties of the particles of fibrine in the interior of each globule of the crassamentum, which are estimated, according to Dr. Davy, at one per cent. of the entire mass.‡

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* Phil. Trans. † Thesis de Coagulatione Sanguinis. 1820.

‡ See Prevot and Dumas, Annal. de Chemie. Vol. 3.

The late Dr. Gordon, of Edinburgh, thought there was an evolution of about 6° of heat, during the coagulation of blood. Hunter maintained, that blood just drawn resists reduction of temperature, whilst its vitality remains. Dr. John Davy, in his Thesis, mentions, that arterial blood coagulates sooner than venous.

The blood, when drawn, either retains its aqueous constituents, with considerable attraction, or else absorbs some from the air, in place of what it loses. The following is the *mean* result of a great number of my trials:—

Ten ounces of blood, placed in a scale for twenty-one hours, lost ninety-eight grains, one-third of which evaporated during the first ninety minutes.

But the same quantity of water, at same temperature, loses much more weight.

Ten ounces of blood, and ten ounces of water, were placed in separate scales of a delicate balance, in open cups, the water being brought to 98_{o}: the blood was at the same temperature.

In one hour, the cup of water lost forty-seven grains more than the blood lost.

In another hour, the water lost seven grains more than the blood.

After this, the two cups remained in the opposite scales for ten hours, without either preponderating in the slightest degree.

It is probable the viscidity of the blood may partially retard the evaporation. During the above experiments, the thermometer in the apartment stood at 50°.

With respect to the comparative cooling of the blood, the following are the medium results. Atmosphere at 50°.

One cup of water, ten ounces at 98°, in five minutes fell ....10 degrees, five do. more... .. 5 do.	Same quantity of blood, at same heat, fell 6 degrs. Five m. more, 3.
15	9

After which, the rate of cooling was nearly equal.

The comparisons of the relative *quantities* and *qualities*, of the other fluids of the human body, in states of disease and health, would also be most important; but, like the subject of the blood, it is too extensive for our limits. Great light has been shed of late on this dark and devious path of Physiology, of which much more remains to be explored.

The coagulum of chyle, is stated, by Vauquelin,* to be an intermediate substance, between albumen and fibrine. He considers it albumen, on its way to assume the nature of fibrine. In the completion of the change going on, is it not likely that the harder, and more solid hydrate of fibrine, would evolve heat, when forming from the liquid albumen?

Meyer says, that the quantity of fibrine is in proportion to the oxygen the animal consumes,—little in such as are cold blooded, greater in men, still more in dogs, and double as much in birds. There is no gelatine in the blood, though so abundant in the solids; therefore, the albumen, or some other principle, must pass into gelatine, after leaving the arteries, and being fixed in the texture.

Mr. Hatchett showed, that albumen can be converted into gelatine, by digestion in dilute nitric acid; and Fourcroy held a similar opinion, that the same change would follow a combination of albumen with oxygen.

Dr. Bostock confirms the statement of Berzelius, that gelatine is not contained in any of the healthy animal fluids. As the relative proportions of albumen, and gelatine, are so nearly similar, we may expect that the conversion of the former, into the latter, in our solids, will affect the consistence of the fluids from which its component atoms are derived.

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* Annales de Chemie, 81. 113.

CHAP. XI.

ON THE INFLUENCE OF ARTIFICIAL HEAT AND HUMIDITY, TOPICALLY APPLIED TO THE HUMAN BODY.

HAVING adverted to the subject of *percolation*, *imbibition*, and *altered condition* of solids and fluids, we come next to treat of some points connected with the foregoing outlines, deducing *practical* inferences from the few opinions already advanced.

In the first place, we propose to advert to the external applications, general or local, of *diluents*, and *increased temperature*, so far as they affect the simple solids, and modify the constitution and functions of the various parts on which they can exert any influence. The consideration of these applications includes BATHS, *tepid* or *warm*, and *vapours* or *fomentations*, *medicated* or *simple*.

Secondly, we will briefly treat of the principal parts of the system likely to be changed, or modified, either in tone, texture, or condition, by altered temperature and contact of humidity.

However extensive, varied, and powerful, the influence of *warm bathing* on the living fibres, and however well calculated to dispose the solids, and fluids, to a proper reciprocal balance of tone and condition, yet it would be tedious, and, indeed, inexpedient, to enlarge on the subject in this paper. Though intimately connected with *this division* of our little treatise, embracing the *practical in-*

fluence of heat and humidity on the living body, yet it would extend far beyond our proposed limits, to enter into a history of these important applications. Though the use of the warm bath extended almost through all ages and nations, and, indeed, formed a kind of criterion of the refinement and personal comfort of a people,* yet, as so many useful publications have issued from the press, and so many invaluable observations on this topic are to be found in modern works, we must decline dilating on the theme, though it might be in itself abundantly agreeable, and even profitable to many readers.

The Hon. Basil Cochrane, Sir A. Clarke, and Mr. Wallace, in this country, Calës, in France, and De Carro and Horn, in Germany, have ably directed public attention to these matters, and particularly to the advantages of sulphureous fumigations, in disorders of the skin.

They have, moreover, established a truth, important in its application to these, as well as other medical investigations, that it is not whether a thing were, or were not, previously in use, practised by Galen, Celsus, or Paracelsus; whether a plan or a practice can be pointed out, in some musty tomes, unnoticed and unknown, forgotten and revived, neglected and again resumed; but whether the practical use be properly persevered in, both with regard to time quantity, and quality, of application, and

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* Fabricius reckoned the number of the public Roman baths, at eight hundred and fifty six.

Among the Egyptian laws we find the following salutary commandments:—

Honour thy Parents.
Be virtuous.
Wash thy body twice each day, and twice each night.
Live upon little.
Reveal no secrets.

Herod. lib. ii. Plat. de leg. Plut. de Is et Os.

condition and susceptibility of system. They have shown, that constant, continued, determined and judicious steadiness of purpose, and constancy of progress, will overcome difficulties and dangers, which would seem, at first, as if not to be surmounted.

The energetic recommendations of local and general vapour and water baths, have excited an attention and interest in their favour, and a system of regularity in their management and arrangements, extending their advantages almost to every city and town. If part of the large sums expended on over-fed Hospital patients, and pampered nurses, on rents of Dispensaries, and outlay of medicine, were *appropriated to the prevention of diseases* among the poor, it is probable that more extensive benefits would be conferred, than can be afforded in the limited and local range of Infirmaries. If half the amount annually spent in the purchase of wine and medicines for charitable institutions, were *early* and *judiciously* laid out in precautionary means of preventing diseases among the indigent, the hospitals would have fewer inmates, and the asylums, for orphans, would not be so crowded.

The expense of an establishment in every village, *free to the poor*, or at least at a small nominal rate, where they could enjoy the advantages of a warm bath, with a drying stove for their *cloths*, and such other auxiliary means as humanity might suggest, would be a minor consideration, when put in competition with the benefits resulting to the working classes, in warding off impending diseases, and the inevitable ruin which is almost invariably attendant in their train. The state supports, at boundless cost, a *preventive guard*, at every creek and corner of our coast; but if the duties were lessened, and the temptation to smuggling removed, half the present outlay would establish *preventive services, to arrest dis-*

eases at their onset, and thus save thousands from pauperism and wretchedness, which seldom fail to follow the death or disability of the head of a poor family.

Economical establishments of this kind might, in a great degree, prevent the fatal consequences of that indiscriminate resort to the sea shore, around our coasts, where, notwithstanding its being useful to persons of sound system, and ordinary vigour, more mischief is effected, diseases fixed and confirmed, and general injury to health and life inflicted, than all the hospitals in the kingdom counterbalance, by their valuable and acknowledged services. The benefits resulting from the latter are circumscribed; the evils from the former, general and unlimited.

The injuries of injudicious sea bathing to the weak, delicate or phthisical female, and children, on the one hand, and to the plethoric, or those subject to inflammatory affections, on the other, are every where felt and lamented.

These remarks, on the ill-advised recourse to cold bathing, are not meant to detract from its merits, as an invigorating and refreshing agent, under proper regulations. The value of cold affusions is incalculable, in abstracting the accumulated heat, in fevers, and in disposing the extreme vessels to healthy softness and secretion. These advantages were long known and experienced in Persia and elsewhere, and were more lately established by Dr. Currie and others in this country.

Referring to the many excellent directions already extant on the subject of bathing, and passing over the auxiliary processes of *champooing*, *friction*, &c., which are so many modes of assisting to alter the condition of the surface, and promote the circulation in the parts affected, I come next to say a few words on the subject of *cutaneous absorption*, so far as it is connected with the introduction of medicinal properties from water or vapours, postponing to another chapter their consideration in pulmonary inhalation.

The subject of *cuticular absorption* has been understood, in the foregoing pages, as admitted; and the experiments I have made, in a great degree confirm that supposition, though I confess that, in many instances, I failed in introducing chemical tests into the secretions, or circulation, of animals immersed in the baths.

The question of cutaneous transpiration, has not been elucidated so certainly as many would be led to suppose, from the numerous disquisitions scattered up and down in medical and physiological works. As the interior and exterior of our organs are furnished with vessels carrying into the mass of blood such fluids as come in contact with them, as well what is presented as nourishment, as what is given off from the changes of elementary parts during the processes of renewal and decay of organic particles, so there is in like manner an obsorption from the surface of the skin. Medicinal, and even nutritious substances, can be thus introduced, where the epidermis is thin or abraded. Some deny that water is absorbed through the scarf-skin; and certainly its insensibility, and almost inorganic nature, favours such a denial. But if the conformation of the epidermis be like a coat of mail, covered with scales, and if they act like valves, and, as some assert, exclude water, they may, nevertheless, admit vapour to penetrate between the squamous plates, and moisten the membrane on which they are set.

The absorption, called Instertitial by John Hunter, affects and influences the molecules of matter, separating them from one organ, and adding them to another; decomposing and regenerating every fibre, and tissue; eating away, as it were, and absorbing up whole bodies, such as the thymus gland, which is carried off in the adult, though so large in the foetus. In fact, as has been well supposed, these vessels, in a certain degree regulate the shape of the parts, and hinder unequal depositions, and undue proportions, from being organized.

The utility of heat and moisture to swelled parts, is inconceivable. Where the absorbents are injured, or indolent, warmth promotes their energy, and causes them to act much more efficiently, in the same manner as inducing slight inflammation facilitates the reduction of inactive glands, by promoting and exciting the absorbent functions. On the contrary, cold applications do good where the exhalants are too active, by diminishing their calibre, and the influx of fluid to the part. Some such distinction between the effects of cold and warm applications, might direct us in the choice of either; or of the cold, at one stage or period of the inflammation, and of warm applications at another.

The agency of the nerves, in directing and regulating absorption, is boundless; and as the cuticular nerves are not active, unless excited, friction or abrasions are requisite, as well to denude and remove the epidermis, as to promote the nervous energy of the absorbent vessels. Passions of the mind, fatigue, debility, and emotions, will promote or retard the process. A man, after a fit of drink, or other debilitating excesses, will absorb contagious virus, though he may escape it when healthy and robust. The mind free from fear, in a great measure exempts a person from the infection of diseases, to which the timid is susceptible, immediately on being exposed to the same danger. Friction constantly acting on the inner coat of the intestinal canal, by the food and muscular peristaltic motion, greatly facilitates the activity of the lymphatics of those parts so pre-eminently necessary to carry and imbibe nutritious fluids. Brushing the skin, in the bath, causes the imbibition of much more water, as I think has been often experienced by the large secretion of urine which at that time took place.

Notwithstanding the general belief so prevalent respecting cutaneous imbibition, I think it right to observe, that in several cases, where the scarf-skin was sound, I failed in detecting iodine, sulphur, and several metallic salts, in the secretions of persons, after being immersed in their solutions.

If none of these could be discovered in the urine, still they might be taken up by the external absorbents, pervade the myriad meshes of inosculating lymphatics, pass from one net-work plexus to another, and be carried away at some other part of the body, by the various communicating inosculations, without entering or following the general circulation of the blood. The following case, related by Richerand,* would seem to confirm the probability of this hybothesis:—

" A young man whom I had ordered to rub in mercury, along the inner part of his left leg and thigh, for the cure of a pretty large bubo, was affected, on the third day, with salivation, though he used only half a dram of ointment at each friction. The salivary glands on the left side, were alone swollen, the left side of the tongue was covered with aphthæ, and the right side of the body remained unaffected by the mercurial action; a clear proof, that the mercury had been carried to the mouth, along the left side of the body, without entering into the course of the circulation, and, perhaps, without passing through any of the conglobate glands; for, that of the left groin, which alone was swollen, did not sensibly diminish in size. Salivation may, therefore, take place, in the cure of the venereal disease, though none of the mercury enter the circulation, which warrants the opin-

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* Page, 155.

ion, that the action of syphilis, as well as of the remedies which are administered for its removal, operates chiefly on the lymphatic system."

If we again refer to analogy, shall we deny that the surface of man can inhale drink, whilst that of the oak can imbibe food? The alimentary cavity of the zoophyte is but an active absorbing surface, as Boerhave, Alston, and A. T. Thompson demonstrated. What is the process conveying nutrition to all animals, but an absorption of aliment, from an animated membranous canal? We notice how the internal tube, which nourishes the polypus, may be turned inside out, and though we make it the external surface, yet its functions of nutrition go on as before. The opinion, that man and other animals have the advantage of absorbing simple water itself, or its vapour from the air, is not so untenable as it might at first appear. The leaves of plants enjoy over their surface the power of absorbing water in the state of vapour, from the atmosphere.

The *cutis vera* enjoys a very high degree of absorbent power through its whole superficies of about fifteen feet square, in an ordinary sized man; but many deny that the epidermis possesses the power of absorption of saline solutions, or even distilled water. Seguin asserts, from his own experiments, that unless the cuticle be abraded, corrosive sublimate, dissolved in water, will not be taken in by a part immersed in it. But, as was hinted before, œriform water, or other liquors in vapour, might insinuate a passage through the squamous structure. This is confirmed by the circumstance, that Mr. Chaussier poisoned rabbits, by exposing their skins only, closely shaved, in a proper apparatus, to the action of sulphuretted hydrogen gas.

Dr. Edwards conceives that his experiments, especially a series which he performed on Guinea pigs, warrant the opinion, that absorption does take place, though in considerably less quantity than during immersion in water; and he finally concludes, that when the body loses weight in damp air, the amount is to be regarded as the difference, between the loss by transudation, and the increase in consequence of the absorption of aqueous vapour.*

With respect to the question of absorption, while the body is immersed in water, the first experiments were performed on cold blooded animals, and he appears to have proved, unequivocally, that, in them, absorption takes place from the skin with great facility, and in considerable quantity. If a lizard be exposed, for some time, to a dry atmosphere, a great proportion of its fluids are removed by transudation; and if we then immerse a part only of its body in water, we may observe a visible and copious augmentation in the quantity of its fluids, both from the appearance which it presents to the eye, and more decidedly from the increase of its weight. He, therefore, infers that a similar operation must be carried on by the human skin, that both transudation and absorption are always going forward, and that the body gains or loses in weight according to the excess of the one above the other. Richerand strongly supports the affirmative of this question.

"The increased weight of the body, after exercise in wet weather; the abundant secretion of urine, after remaining long in the bath; the manifest enlargement of the glands of the groin, after keeping the feet immersed, for a considerable time, in water, an experiment often performed by Mascagni on himself; the effects of mercurial frictions, &c., show, however, in an unquestionable manner, that absorption takes place through the skin, with more or less rapidity, according to circumstances.

* Dr. Hunter thought, that "in scrophula the lymphatics took up some *noxious particles from the atmosphere.—Cruikshank.*

It must be taken into account, that the means which promote cutaneous absorption, operate, at least as much, by altering the structure of the epidermis, as by increasing the action of the absorbing orifices. In this manner the bath appears to operate, by softening the texture of the epidermis; and frictions, by displacing and raising its scales."

The copious flow of urine in diabetes, and the collections of water in dropsies, where paucity of ~~so little~~ ingesta would account for the quantity, has struck almost every writer on these topics. Several cases are on record, where the egesta exceeded the ingesta, to the amount of two or three pounds daily, for several months. Dr. Dill mentions a case of a patient in diabetes, "who, at the commencement of his disease, weighed one hundred and forty-five pounds; and being weighed after the expiration of five weeks, when he died, was found to have sustained a loss only of twenty-seven pounds; but his daily excess of urine, over his ingesta, during the same period, averaged nearly five pounds; consequently, the difference between his urine and ingesta, during the thirty-five days of his disease, comes to one hundred and forty pounds; when the twenty-seven pounds which he lost in weight are subtracted, one hundred and thirteen pounds of urine will remain unaccounted for. Cutaneous absorption presents us with the only and proper solution of this difficulty."*

Dr. Cullen remarks, "*that water taken in from the atmosphere by the skin, in an absorbing or imbibing state,* if not a primary cause of, may at all events tend very much to increase a dropsical affection." Kiell states, that, after exercise, a person will gain ten ounces, in as many hours, by cuticular absorption.

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* Trans. Med. Chir. Soc. Edin. Vol. II., 353.

Mercard, *on Baths*, is decidedly of opinion, that cuticular inhalation occurs in the bath. "Il est donc certain," he says, "que le transpiration augmente dans le bain, et que res vaisseux inhalans introduissent de l'eau dans la masse des humeurs en circulation." Cruikshank and Desault advocated the same opinion. Dr. Scott also supposes, that his acid bath "suddenly increases the secretion of bile and persiration to a great extent, in consequence of peculiar motions, which it has the power of exciting in the solids or fluids of the body."

Doctor Copeland, in his able notes to Richerand, translation, page 631, says, "a careful view of the functions of the skin throughout the different classes of animals, leads us to conclude, that it performs operations which hold an intermediate place between those of respiration and elimination."

Dr. Edwards fully proved what Spallanzani had alleged, that serpents, lizards, and frogs, produce the same changes on the blood and air, by means of their skins, as by their proper organs of breathing. This function enables such animals, during the winter, to live for any length of time under the surface of water.

The opinion of cutaneous imbibition is so general, that a bath of milk, or broth, has been supposed to support life a length of time, in cases where the passage to the stomach was obstructed. On the contrary, Dr. Currie denies that any weight is gained in the warm bath, and insists that fluids are not absorbed, unless they be introduced by force or friction.*

We now see, that the weight of authorities, and of analogies, preponderates greatly in favour of the opinion, that cutaneous absorption is calculated to introduce water, in its fluid or gaseous state, to make up for that waste in

* Med. Reports, c. xix.

animals, which is almost entirely of their watery parts, and the renovation of which must be as nine to one, compared with the reparation of the simple solids. But lest any imputation of partiality to theory should seem to apply, I will candidly set forth a few experiments, and let the lovers of induction choose which side they please. I shall be ready to join cheerfully with the man, who, in the spirit of fair philosophy, will decide the subject of cuticular inhalation. In the interim, I adhere to the opinion, that transpiration by the skin, and lungs, introduces vapour, or water, by one set of vessels, and discharges it by another, the inhalation sometimes exceeding, and sometimes falling short, of the quantity exhaled, but both proceeding at the same time.

Doctor Dill, in the second volume of the transactions of the Med. Chir. Soc. of Edinburgh, confirms the doctrine of the inhalation of water in a bath. He adduces several proofs of the fact, the result of which, I honestly confess to be more favourable to the ideas set forth in this essay, than even the experiments made by myself would warrant. Dr. Dill's bathers invariably became heavier; mine, on the contrary, in every single instance, lighter; and though it would at first seem unfavourable to the speculations advanced in chap. 7, p. 81, yet I annex the general result, which is, that so far from acquiring weight, a loss occurred in all cases, of from an ounce or two to eight, and even twenty-four, during tepid or hot bathing, and this loss is in proportion to the time of immersion, to the state of the person, and to the heat of the bath.

DR. DILL'S CASES.

Bathers.	Temperature.	Time in Bath.	Gain.
A.	86	30 Minutes,	30 Grains.
B.	96	15 do.	50 do.
C.	102	20 do.	0 do.
D.	98	30 do.	10 Drachms.
E.	96	20 do.	loss 3½ do.
F.	96	20 do.	gain 3 do.

MEDIUM RESULTS OF MY EXPERIMENTS.

Many pages might be filled from the notes taken in several hundred trials; but on a subject so easily verified by any person, I presume the following may suffice :—

Bathers.	Temperature.	Time of immersion.	Average loss. Averdupois. Oz.	Drms.
No. 1	88	25 Minutes,	1½	0
2	89	———	2	0
3	90	———	2¾	0
4	91	———	3	0
5	92	———	3½	0
6	93	———	3	6
7	95	———	4	3
8	96	———	5	0
9	97	———	5	6
10	98	———	6	4
11	99	———	7	0
12	100	———	7½	0
13	101	———	8	1
14	102	———	9	0
15	103	———	10	0
16	104	———	12	2

Above 96°, the pulse rises from 70 to 100, nearly in the ratio of the heat, until perspiration breaks out copiously on the face,—respiration increases from 19 to 36. In twenty minutes after dressing, pulse down to 68, and respiration natural.

When the heat it below 95°, the pulse and respiration become slower, almost in proportion to the degree of coldness, to 88°,—but still, even then, an ounce and a half is the average loss of weight. Here the constitutional waste is not estimated in these general calculations.

In the vapour bath, the pulse will run up to 120, or even 130; and after perspiration profusely pours out, it diminishes in frequency; and the average loss, at temperature agreeable to the feelings, is about ten ounces. The vapour is generally applied at 120°.

I have varied these trials, and repeated them so often, that I hope when I speak with confidence in opposition to Dr. Dill, it is the only subject on which I may appear dogmatic, in all my lucubrations throughout this dissertation.

The truth is, the scarf-skin acts as a kind of insensible inorganic coat, or shield, over all the other parts, defending them against voluntary or involuntary ingress of foreign applications, which might be noxious. The acuteness and situation of other senses, enable us to judge, by the sight and smell, of the substances taken by the mouth.* But if our skin were a *ready* recipient of gaseous or liquid bodies, life would be precarious indeed. If we perceive a noxious gas entering the lungs, we can avoid inspiring for a moment, till we escape, or obtain purer air; but if the cuticle were pervious to deleterious inhalation, our system might be poisoned before we could perceive or avoid the occasion of the offence. In fact, the epidermis is rather a secreted shell-work than a living covering. That it is impervious in a considerable degree, is shown by the circumstance of its retaining effused serum, after a blister or a burn, like a perfect membrane, until it is discharged by punctures, or taken up by the subcuticular ampullulæ. The same quality is further shown by its refusal to admit variolous,

* "Nares, eo quod omnis odor ad superiora fertur, recte sursum sunt: et quod cibi et potionis judicium magnum earum est, non sine causa vicinitatem oris secutæ sunt."—*Cicero de Natura Deorum, l.* 2, *c.* 56.

vaccine, or other virus, until the scarf-skin is abraded or penetrated by slight incisions.

I annex the case of *Buonaparte,* to confirm the theory, that absorption of certain test liquors, and of course certain medicines, may enter the system, through *the skin,* in a warm bath, and, consequently, that the speculation of medicated baths is rational, and should be further investigated. This plan of making a sudden impression on the system, should be carefully inquired into, where it is desirable to induce an immediate effect, or medicinal influence, as in cases of croup, tetanus, &c. &c. Though I failed to detect the imbibition of gallic acid, in two or three instances, yet, in the present case, it was manifestly introduced and detected, after the second trial.

Buonaparte, (not Napoleon, I regret,) but the most powerful pugnacious porter about the mail-coach offices of this place, in some of his hundred battles, received certain convincing arguments, which gave him an inclination to look rather too much to the right. For this stiff-necked ailment, I employed the very superior warm bath of Mr. Milliken, into which Buonaparte descended, at 98°; the heat was gradually raised to 100°, and his pulse and breathing became more strong and numerous. In the water, some time previous to his immersion, four ounces of powdered galls had been infused; during the last fifteen minutes, an attendant brushed the skin, and neck, until they were red. When immersed half an hour he ascended from the bath. Next morning his urine, and the serum of his blood, were tested with salts of iron, and no trace of gallic acid exhibited. The pains about his head and neck not being entirely removed, the bath was repeated, the second night after, and in two days more blood was drawn. The serum, on separating, became slightly brown with solution of sulphate of iron, which, on absorbing oxygen, in a few days more, gave it a blackish tinge.

No doubt, in such experiments, where so very little water could be absorbed, the proportion of gallo-tannin likely to enter the lymphatics, would be extremely minute. Probably, from the astringency of the galls, and their effects on membranes and tunics, their infusion was little calculated to be absorbed at all; certainly, on the first occasion, though the epidermis was actively rubbed and brushed, no trace of the test could be detected in any of the fluids next day.

The crassamentum of a person, some days after being immersed in a bath containing galls, was cut in two pieces, and laid on white paper; one piece was sprinkled with a dilute watery solution of the tincture of iron, and became black in twenty-four hours; the other piece became redder. I would not attribute the blackness to the galls, for common water, poured on cruor, blackens it.

A few days after, I immersed a boy in a bath, in which two drachms of prussiate of potass, had been dissolved; a little of the water taken out of the bath, struck a fine blue with dilute tincture of muriate of iron. This boy remained half an hour, was actively brushed most of the time, and friction employed along the course of the lymphatics; he was bled next day,—the serum, on separation, showed no trace of the prussiate, when tested with iron.

But admitting that in case the prussiate had been absorbed into the thoracic duct, there are abundant modes, and plenty of systems of separators, acting like strainers, such as the kidneys, which would clear the blood of that salt, as fast as it might enter; or, if not passing directly by the circulation, these excretories might prevent its ingress into it at all.

Thinking that the portion of prussiate was too small, and rather unwilling to employ much of a salt containing prussic acid, I repeated this experiment on myself, with double the quantity of prussiate, without any result.

I next took a young pullet, and had it immersed in a basin of warm water, containing an ounce of the prussiate. In this the pullet remained an hour, with its head raised through a hole in the lid, so as to avoid coming in contact with the liquor. At the end of the hour, the poor animal appeared very languid, and was taken out; it seemed as if intoxicated, and unable to stand, probably from the great debility, induced by a warm bath, so long continued. In twenty-four hours it was quite recovered, and its dejections during the time, though of course containing urine, produced no blueness with muriate of iron.

Its comb was cut, and the drops of blood from time to time falling out, exhibited no trace of change, with the test. Some of its soft pen-feathers, when pulled out, contained blood, which, when tested, was in like manner unchanged:—the pullet recovered perfectly. On the second day after, it was immersed in a basin of warm water, containing half an ounce of muriated tincture of iron. It remained half an hour, and, on removal, soon recovered: next day it was killed, and neither the blood, flesh, nor secretions, seemed at all changed in colour. The gall bladder was filled with a thick liquid, intensely blue; but I have seen those of other fowls remarkably deep tinged, when not subjected to any such trials.

John M'Culloch was immersed in a bath, containing infusion of galls, for half an hour; on bleeding him the second day, the serum, when separated and filtered, was allowed to settle, and, on becoming clear, a weak solution of sulphate of iron was added; at first no change but a reddish cloudiness took place, but on setting the phial aside, uncorked, a black colour appeared on the top of the liquid; in a few days the entire became black: another phial of the same serum, without the iron, exhibited no change. I concluded that the infusion of galls had yielded some of its gallo-tannin to the blood, through the medium of the *bath*.

The spleen (of which we spoke page 57) is said to exert great influence on absorption. Sir E. Home made some curious experiments showing the power of the spleen in absorbing fluid, from the stomach, which he detected by re-agents. In a subsequent paper, in the Phil. Trans. he seems to have changed his opinion respecting the function and structure of that organ.

Sulphur colours silver in the pockets of those who remain long in its vapour bath, as it does with those who rub the sulphur ointment on the skin. I have observed, that the sulphur blackens a silver watch-case of a person, after having used the sulphuretted vapour bath several times; even when the head is quite free from the contact of the vapour, and after the skin has been washed in the water bath. The sulphur bath should be an efficient preventive remedy against the *colica pictonum;* probably its use, once a week, would guard the painter against this insidious disease.

The skin, and lungs, admit lead; hence its vapours, in the neighbourhood of mines and works of that metal, are deleterious to man, and inferior animals, such as swine and poultry.

Disease and death too often follow the custom of sleeping in apartments newly painted with white lead, which is a strong proof of absorption by skin and lungs.

In March, 1810, two hundred men belonging to the *Triumph* man-of-war, were put into Gibralter, alarmingly salivated, owing to the evaporation of the bilge-water in the hold, conveying the vapour of mercury, which had fallen out of the casks, and which arose like steam, blackening the entire vessel and rigging.

The local imbibition of mercurial ointment, solutions of opium, and other narcotics, the application of tobacco, emetics, and purgatives to the skin, producing their peculiar effects, are subjects generally known to all medical men, and are more or less additional proofs of cutaneous imbibition.

Now, though all our experiments on bathing clearly show the quantity of inhalation to fall far short of what is exhaled, yet it does not prove that the former does not take place. In the warm bath there is a current of all the fluids to the surface, distending the extreme ramifications of the capillary vessels. This fulness of the absorbents hinders them from being excited at their mouths, and from drawing in the liquids, when presented to them in a state of plethora, or in a condition of unfitness for imbibing fluids, owing to the already saturated state of their ampullulæ, or tubercular orifices, and even of their lateral pores, if such they have. Besides these reasons of a temporary cessation of imbibition, we might admit, that the water could be absorbed and leave the suphur, gallic acid, iodine, ammonia, &c. unintroduced, for, as physioligists hold, all absorbents evince a kind of elective attraction, take what they effect, and leave what should be rejected. They say, the lacteals choose the digested and nutritious particles of aliment, conveying them to the thoracic duct, and, at the same time, refuse to take up odoriferous, colouring, and several saline substances. Thus indigo, alcohol, or gamboge, could never be detected in the thoracic duct, or lacteals, though their dilute solutions might enter the blood by percolation or imbibition, by venous radicles, or by capillary attraction. Though I do not entirely agree with this picking and choosing faculty of absorbents, yet all must admit, that heterogeneous particles, or even qualities of matter, unfit for nutrient combinations, may alter the arrangements of aggregation, or even mechanical disposition of the globules they touch or join, and render them less likely to be absorbed; but particularly that such things as are hurtful, or would be likely to injure, if taken into the circulation, may have the quality of contracting the ampullulæ or orifices of the absorbents, so as to be refused admittance, just as the epiglottis will endeavour to close, and hermetically seal the cavity of the chest from the inhalation of fixed air.

CAP. XII.

ON THE COMMUNICATION OF HEAT AND HUMIDITY, BY BATHS.

HAVING, in this division, alluded to the long disputed subject of cutaneous imbibition, from the atmosphere, and from baths, I will briefly refer to the advantages, and disadvantages, of bathing in general.

It is certain that the hot bath above 98° quickens the healthy pulse, almost in the direct ratio of the heat, at least until perspiration breaks out; the breathings are also increased in the same proportion: therefore, if a more frequent pulse, and more rapid respiration, be injurious in inflammatory disorders, we should hesitate before permitting a patient to resort to a measure which certainly hurries both. Unbiassed to any side of a question, it is my duty to caution those concerned, that careful consideration is requisite to decide, whether the good effects of hot bathing, in producing diaphoresis and deliquium, be equivalent to its properties of hastening the current of the blood, and quickening the labour of the lungs. These precautions are the more requisite, if inflammatory fever, pneumonia, phrenitis, or indeed any active inflammation, be threatening to come on. Certainly, in opening the pores, a warm bath would conduce very much to procure relief and relaxation; but if a man's pulse beat 120° in a minute, is it judicious to subject himself to any measures likely to raise the pulsations, even for a short time, to 140°?

These cautions are the more necessary, as the agreeable sensation of increased heat, after being some time immersed, tempts bathers to call out for further supplies of hot water, unconscious how much it affects different persons, in different ways.

The more general extension of baths in various places, and the utility of widely diffusing such valued observations as those of Professor Duncan, though well known and appreciated among the members of the profession, will, I hope, excuse me for requesting further attention to his excellent remarks, among the directors and proprietors of baths in this country. I would not take the liberty to quote from a work so well known as his Dispensatory, but that it places the effects of bathing in a light, proving the necessity of regulation, and because Mr. Wallace, in his essay on bathing, says, page 77, when very judiciously enforcing the necessity of proper attention to baths, and patients, during fumigation, that "the greatest care, cleanliness, and exactitude in the employment of fumigations, are absolutely necessary to their success. The *patient is subjected to an operation, very different indeed from that of a bath, which can be administered by the rudest attendant.*" As I fear the last member of this quotation may mislead, I am induced to subjoin Dr. Duncan's judicious opinion of the effects of a hot bath.

"The *hot bath* is decidedly stimulant in its action. It renders the pulse frequent, the veins turgid, the skin red, the face flushed, the respiration quick, increases animal heat, and produces sweat. If the temperature be very high, the face becomes bathed in sweat, the arteries at the neck and temples beat with violence; anxiety, and a sense of suffocation are induced, and, if persisted in, vertigo, throbbing in the head, and apoplexy, are the consequences."

In order to impress still more what has been often advanced in these pages, that a very small increment or diminution of temperature, may directly or indirectly produce very important *differences of result*, I cannot do better, than by adducing another quotation from the same distinguished author, on the subject of the *warm bath*; and I trust the owners of such establishments will bear in mind, that the *warm bath* ranges from 95° to 98°, and the *hot* from that temperature to 102°; and sometimes to a heat very far above what it should be.

"The warm bath excites the sensation of warmth, partly because our senses are merely relative, and partly because its temperature, though less than that of the internal parts of the body, is greater than that of the exremities, which are the chief organs of touch. But as water is a much better conductor of caloric than air, and especially than confined air, as much caloric is abstracted from the body by water, which is only a few degrees lower than the internal temperature of the body, as by air of a much lower temperature. The warm bath diminishes the frequency of the pulse, especially when it has been greater than natural; and this effect is always in proportion to the time of immersion. It also renders the respiration slower, and lessens the temperature of the body, relaxes the muscular fibre, increases the bulk of the fluids by absorption, removes impurities from the surface, promotes the desquamation and renewal of the cuticle, and softens the nails and indurations of the skin. The stimulant power of the warm bath is, therefore, considerable, and its employment in disease will be chiefly indicated by preternatural heat of the surface, and frequency of the pulse, rigidity of the muscular fibre, and morbid affections of the skin. It has, accordingly, been found serviceable in many cases of pyrexia, both febrile and exanthematous, in many spasmodic diseases, and in most of the impetigines. It is contra-indicated by difficulty of breathing, and in internal organic affections, and should not be used when the stomach is full."

These remarks embrace the merits of the *water bathing* so accurately, that we may now proceed to speak of its application in the œriform state; the qualities of the one kind of application, being so analogous to those of the other, that their general influence, as *media* of communicating heat and moisture, may be discussed in one place. Dr. Darwin says, " the story of Æson becoming young, from the medicated baths of Medea, seems to have been intended to teach the efficacy of warm bathing in retarding the approach of old age."*

ON THE COMMUNICATION OF HEAT AND HUMIDITY BY VAPOURS.

THE INFLUENCE OF TEMPERATURE AND MOISTURE in the process of vapour fumigation, if general, will be to dilate or enlarge the subcutaneous vessels, and consequently to diminish any degree of a plethoric state of the internal parts, and particularly, if that over distension exist in such excess as to produce disorder, or a tendency to disease *of the vital* organs. The more the contents of the distended interior vessels are determined generally to the smaller ramifications of the entire surface, the more, of course, will the tension of the trunks and

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* Zoonomia, p. 686.

larger branches be diminished; and the plethora being removed, even during a temporary period, will go far to take off the over-stretching of the nervous and vascular tissues, lessen pain, and induce a disposition, or condition of the parts more suited to healthy action, and due discharge of functions.

That the blood, when determined to the surface, partially leaves the more deep seated organs, and arteries, is evident from the red and full appearance of the cuticular vessels, and the weakness induced, which is also a cause of the more frequent pulse.

This faintish state produces a languor and deliquium very favorable towards the suspension of inflammatory action, and the diminution of the proportion of fibrinous constituents of the circulating mass; for the greater the debility, languor, atony, and relaxation, the less will be the disposition of the atoms to combine in the proportion for forming fibrine. Hence, probably, the great powers of large doses of tartar emetic in pleuritis, &c. superinducing a state approaching to asphyxia, arresting or retarding the evolution of more animalized proximate principles, and increasing that of a more aqueous nature.

This, no doubt, happens to a certain extent, when the large vessels become comparatively empty, when their contents are determined to the minute ramifications, and when the relative vacuum of the larger ones is filled up, by the admixture of a sudden supply of lymph.

The importance of being able to superinduce these effects on the animal frame, without the use of heating or stimulating exhaling medicines, sickening or nauseating diaphoretics, or the risk of too much depletion by venesection, cannot be denied. The question therefore will be, the best modes, periods, cases, and circumstances, for the application of this powerful remedy. No medicine will sweat a horse without sickening him; and, no doubt, antimonials, hippo, and most diaphoretics induce nausea, more or less, before men perspire. There may be instances where it would be very desirable to induce perspiration, where patients cannot swallow, or where the stomach rejects all medicines.

Rye estimated the daily loss by insensible perspiration at fifty-seven ounces, but this included the pulmonary transpiration.

Lavosier found that the quantity conveyed away in twenty-four hours, by cutaneous exhalation, was thirty ounces; that by the lungs fifteen.

Dr. Edwards states, that transpiration proceeds more rapidly in hot, than in cold air, in the proportion of ten to one:—its quantity at 68° is twice as much as at 32°; and at 104°, seven times as much.

Several physicians deny the potency of warm vapour of water only, when not medicated; affirming, that hatters, calico-printers, and others, who work in an atmosphere of steam, are as liable to phthisis as those who live in the most arid air. It is a fact, that both classes of operatives leave this hot steam, go home to a damp, cold, and cheerless house, on a wet, earthen floor, with a bad bed, and worse diet and drink; and that the sudden transitions, and not the actual steam itself, may render them more susceptible of the disease.

That the effects of warm aqueous vapour, on mucous tissue, is the most material consideration in its employment, is shown by its power of increasing the secretion and separation of that glairy liquid. The mucous tissues are but altered continuations of the external skin, throughout all their openings and canals. Is the head stopped with cold, (as the vulgar term it,)—the warm inhalation sooths and bedews the schneiderian membrane over all its thousand convolutions, softens its consistence, takes off the disagreeable sense of stretching, extension. and pain, promotes the flow of viscid discharges from the nose, if long enough continued, disposes the entire skin to sweat and relaxation, and often hinders more serious extension of the membranous thickening and obstruction to the bronchial surfaces.

Under proper regulations, and at proper times, the same results will follow its use, in similar affections of the mucous tissues of the eyes, ears, mouth, and fauces, and, indeed, of various topical parts of the skin and glands.

It would be a waste of time to dilate on the probable effects of long continued warmer temperatures, on adipose matter, or membrane; because that will strike the reflecting mind, as a subject worthy of ample consideration, and deserving of such investigation and attention to the results, as it is not possible for a single individual to bestow.

With regard to the power exercised by warm fumigations over the nervous tissue, a great deal of the effects are *indirectly* produced. Whatever has the quality of reducing tension, hardness, rigidity, or mechanical obstruction and spasm of a tissue, organ, or structure, will lessen the excitement of the tela or fibres of the nerves of sensation supplying that part: besides, if we admit what I have ventured to suggest, with a great deal of diffidence, that heat and moisture have the power to alter or modify the condition of living matter itself, and to dispose it to be more susceptible of mutations of the aggregations, atomic proportions, consistence and constitution of the parts of that matter, comprising an organic fibre;—if this be true, may not a long continued exposure of nervous fibrillæ, either of their pulpy termination, or filamentous conformation to the action of a pervading, diluting agent, like the vapour of water, when aided by a great chemical power like that of heat, alter the ultimate arrangement of some of their elements, so far as to change the tonicity and sensibility of the nervous structure itself, and its functions, at the time.

These hypotheses seem to be more reconcileable to the mind, when we advert to the circumstances, that perception is so distinct and varied in different people, and in the same person, at various times, altered by heat, changed by cold, and liable to numerous modifications, by the action of stimulants, sedatives, or narcotics.

Without entering on the long disputed point, (incredible to me,) of a "*subtle elastic fluid pervading the medullary substance*," or the question of "*nervous vibrations*," it may be observed, that the consideration of the mutation in the disposal of the order of arrangement of a very few determinate organic materials, will apply to the nervous functions in whatever way their discharge is regulated in health and altered in disease; and again, that the indication of medical proceedings will have, for one object, the intention of bringing about a condition conducive towards a restoration of those laws regulating the just order and proportion of the natural and sound conformation and composition.

In recommending the application of warm baths, or vapours, to relax a part or the whole of the system, I do not join in the groundless prejudice, that these agents produce permanent weakness, as is generally supposed. Where the tone of a part is to be softened, irritability and spasm removed, constriction of surface or membranes rendered expansible, and the diameter of capillaries enlarged, then the long continued contact and imbibition of aqueous vapour is requisite, as well to saturate the interstitial structures with moisture, as to induce fatigue and inactivity of fibre. For this is a distinction to be well observed, where we wish to excite higher action and brisker circulation or secretion. In such cases the water should be applied hotter, containing some medicated excitant, and applied for a shorter time.

A ship captain, just returned from New Orleans, states, that early last summer, 1828, his sailors and many others contracted a disease, which was there called *dandy* fever, from the stiffness and rigidity of the muscles. Immediately on its accession, the skin was hot, soon became parched and arid, rattled, on being touched, like withered leaves, or a dried bladder; the fingers were feeless, and the surface insensible. When the medical attendants came on board, they had the ship's coppers filled with water, which was boiled; blankets were saturated with the boiling water, and loosely wrung. The patients were enveloped in these hot wet blankets, in bed. Care was taken not to wring the blankets dry, but to leave as much water in them as they could retain. This treatment, he says, was persevered in, and renewed, until copious perspiration was elicited, and then sure recovery ensued.

We may fairly infer, that dry blankets, heated to the same temperature, could not be beneficial, nor contribute a medium for carrying off the heat, which would have been confined and accumulated by hot and dry covering. Add to this, the water sooths and softens the sentient nervous papillæ, which expand on the surface of the skin, and almost compose its internal texture. The relaxation of the nervous sensibility, thus induced around the exhalant orifices, reduces their contractility, and disposes to that *condition* fitted to throw out the perspiration, and to discharge the other functions of the capillary ramifications.

The warm bath, and more particularly vapour, exert their most sensible influence on the *mucous membranes*, and, from their connexion and similarity of structure on the skin itself, with which they come immediately into contact and communication. When we recollect, that the subcuticular surface is a congeries of ampullulæ of these minute vessels, we will the more readily appreciate the importance of such a general medium, in restoring the due atomic harmony and healthy action of these extensive transpiring orifices. Some mode like that pointed out, or the warm or tepid bath, by immersion or affusion, present the most unobjectionable means of inducing these desirable results, and, moreover, of contributing to the invaluable and agreeable advantages of personal cleanliness. The persuasion of the purity, derived from these ablutions, gave rise to that emblem of perfect exemption from taint or dishonour, which was designed to be the characteristic distinction of the ancient Order of the Bath.

The comparative value of water and vapour bathing, would lead to tedious discussion. The advantages of the latter in being calculated for *inhalation,* and, as it were, *bathing the lungs,* places it pre-eminently over every kind of fluid bath. There are many superior qualities possessed by vapour:—its difference of specific heat, and the convenience with which it can be applied to patients, even in bed, and in rooms where it would be very inconvenient to bring water, all claim our decided preference in its favour. Its value is further enhanced by its easy adaptation to local affections, as in topical applications, which can be directed to, and confined upon, any point or part affected. It has, further, not the least recommendation, its moderate, indeed trifling, expense. I have, in a few minutes, applied a most efficient rubifacient stimulant, or active blister, as might be desired, to old, indolent, chronic inactive diseases of the joints, to paralytic limbs, and to any part requiring a speedy stimulus. This valuable topical remedy does not cost a penny. A spoonful of slacked lime, and one of powdered sal ammoniac, are put into a saucepan, iron skillet, or a small kitchen pot, about a quart of water is added; the sleeve of an old coat, or a stocking cut at the foot, so as to be open at both ends, saves the irksome and objectionable display and expense of machinery. One end of this homely conductor is tied round the lip of the vessel, or pipe of a kettle; the other drawn over the joint, or part of the limb affected, and bound round it with tape. Parts inferior to this, and not requiring the excitement or blister, will be perfectly defended, if desirable, by folding round them a linen cloth wrung out of vinegar, and nearly dry,—the vessel, or pot, is then set on the fire, the ammonia soon rises, diffuses itself around the part exposed to it, and, by its duration, can be made to stimulate, or even exulcerate the surface to any extent.

This application, whether aided by the agency of the heat, or the more permeable nature of the vapour, is undoubtedly superior in efficacy to ammoniacal linaments, or friction.

Should this meet the eye of celebrated practitioners of large and wealthy cities, they will look upon the subject as very trifling indeed; but in extensive country practice, simple contrivances sometimes are very necessary, and will be attended to, when complicated machinery can neither be purchased, managed, nor understood.

Whatever cloth the conductor be made of, will contain and convey vapour better, if previously wet.

I have just now learned, that for conducting the simple steam of warm water, Doctor Macartney, the able Professor of Anatomy in Trinity College, Dublin, recommended a tube of double flannel. I believe that those physicians who prescribe the inhalation of vapour from oak-bark decoction, in phthisis, order it to be inhaled from a similar bag.

In some of the periodicals, it was stated, that tanners were not observed to be liable to consumption, and hence the oak-bark vapour was recommended.

I have lately been informed it was used by a young medical gentleman, near this town, in his own case, with advantage.

For the reasons above stated, I simplify the mode of admission of the strong mixture of iodine and watery vapour to the eyes, in cases of inflammation, where the tunics are relaxed, and the circulation and absorption languid. In place of the boiler on a spirit lamp, and a bag open at both ends, conducting the vapour to the eyes, the purpose is very well answered by placing a large basin, or jug, full of boiling water, on a table, throwing in about half a drachm of iodine, leaning the face over, with the eyes open, and approaching nearer, as they can bear it, confining the steam about the head with a cloak or mantle thrown over the shoulders, and covering the vessel all around. It will be easily seen that all these matters are very susceptible of improvement.

The comparative agency of various fluids, in vapours or baths, have not been sufficiently ascertained. Fixed oils are with difficulty vaporizable. From what was said before, on the defence of internal parts from air or lower temperature, during operations, there is little doubt but that vapour of water, or topical baths of warm oil, deserve consideration as instantaneous local remedies for recent injuries, such as extensive wounds or lacerations. Whatever can diminish pain, already existing, should be capable of preventing its acuteness, when about to come on. As *hot baths* and *fomentations* relieve pain, it is natural to think they would lessen the sensibility of parts, at the moment of being cut, torn, or bruised. Is this the reason why smiths, and other artificers, when burned, run to the fire and retain the skin near the heat, until the pain is in a great measure removed?

That this effect takes place, is sufficiently well known; and we might here explain the most probable causes of the relief and prevention of suffering. Two theories of the modus operandi present themselves; one is the diversion of feeling effected by adducing a new sensation from the higher degree of heat applied, in the same manner that aconite banishes severe sciatica, but which again returns when the new action of that potent application ceases. This is an influence connected with the nerves.

The second explanation of the influence of heat, affects the circulation; for when any portion of the frame is injured, excitement is produced. Warm media keep up a uniform activity for a longer period, so that a less sudden subsidence takes place where there is a gradual reaction. Hence the injury is diminished, where a slower change comes on, than where there is a sudden and violent alteration of the vascular organization of the part. Thus, if you drop hot melted wax on the skin, it burns, if instantly rubbed off; but if you permit it to remain till cold, the excited vessels have time to recover their calibre, the arteries and veins gain their first proportions of circulation, and no injury ensues.

In a similar manner, there is reason to believe that a diversion of the nervous sensibility might take place, from keeping up a considerable degree of temperature on the part affected, and allowing that heat to subside by slow and imperceptible gradations, until the vascular actions are duly balanced and restored.

Though the treatment of scalds and burns may be foreign to this treatise, yet a case may be adduced, as well to elucidate the topic before us, as to convey a hint to parents, or friends, how to act on a sudden emergency, by which they may probably save a suffering child or relative from death or deformity. An instance similar to the one now brought forward, I published in the Belfast Magazine, in 1810, when Doctors Kentish and Kinlake carried on a long contention on the management of burns. Their papers appeared in the Edinburgh Medical and Surgical Journal of that time.

Passing, one day, through Talbot-street, my attention was arrested by loud screams. On reaching the room of a house from which they issued, I found that a boy had slipped off a chair, on which he had been standing, into a pot of boiling broth, which had just then been set off the fire on the floor. Both legs were immersed for some moments up to the knees. His mother having extricated him, whether with the instinct of nature, or reading Sir James Earle's praises of ice for burns, whatever impulse actuated her first efforts to administer comfort to her child, she plunged one of the limbs into a deep can of cold water: at the moment I entered, the other was just about to be immersed in a similar vessel.

The instant of danger, is not the moment for deliberation. I at once laid hold of the scalding leg just dipping into the frigid pail—held it up—threw into the vessel a few ladles of the boiling broth—quickly introduced the limb into this warm mixture, and retained all the scalded part under its surface—pain was certainly increased by this procedure—the plan was neither congenial to patient or parent—still I persisted, notwithstanding the murmurs, "*not loud, but deep*," which the busy bystanders circulated unsparingly around. This was the right leg, subjected, as was supposed, to the *wrong* practice. The left was kept, by the poor mother of the boy, in the cold water. She had the satisfaction to hear that her plan was removing all the pain, whilst mine was thought a repetition of the scalding a second time.

Here, however, was a case for conviction. Two limbs of the same individual, both equally scalded, immersed the same period of time, and same height, in boiling broth, were almost accidentally submitted, the one to the cold, and the other to the warm mode of management. Setting aside any impressions on the system, I persisted in obtaining topical fair play, for this comparison.

When the limbs were about an hour immersed, they were folded up in cotton, and the patient was then laid in bed. The right limb was red, and inflamed, and painful; the left paper white, puffy, and insensible. Next day it was evident, even to the prejudiced attendants, that the limb treated by me maintained its circulation throughout its entire surface; whereas that of the left had ceased through all the integuments. *My leg and foot,* as they were called, were well in a week. *The mother's limb* lasted long enough, sloughed, and threw off portions of skin and sphacelated cellular membrane, for months. The recovery, of course, was slow, and the surface seared with seams and cicatrizations.

Some such *ready remedy* as the above, might be instantly obtained to form a bath for a burned limb, or to wet warm cloths for a fomentation to other parts of the body, until the minute arteries and veins regain the relative capacities they had lost for a moment, and the balance of their circulation shall be reinstated. Cotton being a bad conductor of heat, retains the warmth of the place, and prevents the accession of air; but it is seldom *at hand* in time to *prevent* the disorganization; but wherever there are materials to scald or burn, a hot fomentation can be easily and instantly procured.

The connexion of this topic with our chief subject, HEAT, and the deep anxiety all men should evince, to extend and circulate every possible method of alleviating the miseries of a sufferer from fire, will, I trust, excuse this digression.

A brave man, struggling with adversity, has been held up as an example of virtue and resignation. There are few more deplorable instances of wretchedness endurable in this life, than when a man has lost his all in a calamitous conflagration, and now lies scorched and burned, after having attempted to rescue his hapless family from the flames.

"Cuncta jacent flammis, et tristi mersa favilla."

With regard to warm applications to wounds, or inflamed parts, some may object, that heat may tend to solicit more blood to the place, and, of course, to inflame it much more; but as there are greater diameters of venous tubes, in every part, than of arterial; or as the heat will expand the veins as much, or more, than the arteries, the blood will circulate *from* the place with an increased ratio, proportioned to that with which it *arrives* there;—viz. if the quantity passing through the arteries be larger, from the expansion and excitement occasioned by the heat, so will the portion, carrying away by the veins, be larger also. It is thus, that the effect of the fomentation is important on the vessels beyond the circle of the complaint; but the great object of continuing the proposed applications is, to enable the vascular tissues to gain time to recover their relative action; because animal and vegetable matter is very impatient of sudden mutations, but accommodates itself, in a wonderful and incredible manner, to gradual changes and transitions.

The above opinions are urged only as an addditional recommendation to the principal design of using vapour fumigations, or hot oil, in the exclusion of air, and consequent prevention of those atomic alterations which it instantly determines, when admitted to the living fibre. There is also this important consideration, to avert the sudden exposure to colder temperature than usual. We might adduce many proofs to show, that animal and vegetable life and health are more affected and injured by a sudden reduction of a certain number of degrees, than by a proportional rise of the thermometer. Plants will live, and men will enjoy health, in an atmosphere thirty degrees above what is natural to their former clime, who would die, if exposed for a single night, to cold, thirty degrees under the medium temperature, to which they had been always inured.

Having instituted many experiments, which confirm the propriety of defending the fibres and blood from air and cold, I adduce a few of them here, rather than in the preceding chapters, because they refer to practical conclusions, which is now our consideration. Two cups of blood were drawn from the same orifice, in a case of pleuritis: one was left exposed to the air; over the surface of the other, small drops of oil, at 98°, were allowed to fall from a pen; under these drops, the blood remained of the same colour as when drawn, but the intermediate spaces soon exhibited the white, organic, buffy coat, like skin, presenting a very beautiful appearance, as if islands were scattered on the surface of the cup, and protected from the air by the drops of oil. The blood, in the first cup, was buffy all over its surface. Since the subject connected with these experiments was printed, (Chap. III.) I found the application of oil beneficial in the case of the boy, (M'Creight,) when I was performing the operation for stone in the bladder. The oil prevented the interstices of the cellular membrane from admitting the urine; there was no infiltration of that fluid, and a speedy recovery followed.

A second simple experiment also shows the influence of air, or evaporation, on animal texture.

Two slices of fresh beef were recently cut: one was left exposed to the air, and its surface became hard and black; it also lost weight: in fact, it seemed not to absorb oxygen, but rather to part with water, and all the other elements, except carbon. The other piece of flesh was covered with warm oil, and those changes were prevented.*

The prevention of rust, or oxidation of metals, by a coating of oil, is familiar to all.

No. 1.—Ten ounces of blood were drawn from a strong healthy man, into a cup, atmosphere at 50°.

* These experiments, with many others, I had formerly read to the Royal Physical Society of Edinburgh.

In twenty-four hours the crassamentum was red and florid, but without buffy coat, and floated in the serum, which was clear.

No. 2.—Carbonic acid was copiously generated in a large tub, by powdered marble, and dilute sulphuric acid; the arm and bleeding orifice of the vein were held over this gas, and a cup of the blood received, at the bottom, which was kept in the dense atmosphere of fixed air, the tub being covered close. In twenty-four hours this cup showed a more milky and yellowish serum than No. 1, and its quantity was greater. The crassamentum did not float in it. The coagulum was covered with a tense firm membrane, of a grey colour, and skinny consistence, studded with depressions, like the marks of recent small-pox on the skin. The texture was much firmer than that of No. 1, so that a probe, passed across under the coagulum, lifted up the mass of cruor, without breaking its condensed covering.

This was rather an unexpected result, to find this membrane much more organized, and dense in texture, in an atmosphere of carbonic acid, than in common air. The crassamentum of each cup, when broken up, seemed equally black.

No. 3.—Ten ounces more of the same person's blood was allowed to flow into a cup, in an atmosphere of ammonia, generating from hot moistened lime and sal ammoniac, in an iron vessel; in this, the cup remained twenty-four hours, covered with a lid. On taking out the cup, the blood appeared of a greenish gelatinous colour; the serum was more viscid than that of the other trials The upper surface of the coagulum was covered with a loose puffy jelly, which was easily detached, and lifted up quite loose, like a broken mucous membrane, but so void of texture and consistence, as to fall from the fingers like boiled starch; from all which it appears, that ammonia has some influence in preventing the adhesion of coagulable lymph. It is certainly an active decomposing gas, and exerts great energy on animal matter.

Some practical deductions from this last experiment, will be ventured, when we come to speak of INHALATION of vapours in croup, and other diseases of the mucous membranes.

Having endeavoured to direct attention to the general consideration of the effects of baths and vapours, and the probable influence of various media, tending to prevent the action of cold, or of air, on parts of our system unaccustomed to their contact, I will conclude by adducing a few more proofs of the general efficacy of these applications.

In cases of pain from the passage of biliary concretions, or urinary calculi, the warm bath affords alleviation of the distress, and facilitates the transit of the bodies, by relaxing and enlarging the canals.

The use of vapour has been resorted to in almost every clime and country, and even among those but a short way advanced in the arts of life.

The variety of medicinal fumigations, has been, at different times, very extensive. Sir Peter Lalonette wrote an ingenious work, in which he relates a number of cases of cutaneous diseases, cured by immersing the body in mercurial vapour.

Sir A. Clarke (on Bathing, p. 41,) forcibly recommends "*tepid and vapour baths during the period of pregnancy, and even of approaching parturition.*" The bath is here inconvenient; but where requisite, or not contra indicated, the long continued application of moderately warm vapour is safe, easy, and agreeable.

A learned traveller in the north of Europe thus writes: "There is no cottage so poor, no hut so destitute, but it possesses its vapour bath, in which its inhabitants experience both comfort and salubrity; and it makes so necessary a part of the system of living, that it is used by people of every age, and in all circumstances, by infants, and by women at their lying in; in almost all sicknesses, before and after a journey, after hard work, or excessive exercise, and to obviate the effects of fatigue."*

CAP. XIII.

ON INHALATION OF VAPOUR, AND ITS REMEDIAL APPLICATION TO THE ORGANS OF RESPIRATION.

DURING twenty-two years, I have abundant proof that medicines, taken into the stomach, can convey little *direct* benefit to the lungs. Certainly, *indirect* relief may be obtained, by their effects on the skin, circulation, and digestion; but to expect immediate pectoral advantages from remedies, they must be applied more local ly to the organs of respiration. Dr. Beddoes, who employed factitious airs, and all those who recommended mixtures of various gases and fumigations from pitch, tar, oil, &c., failed, partly from the want of beneficial qualities in the airs, or vapours, themselves,—from being used at incompatible stages of the illness, but more particularly, from their inhaling the gases in a dry state.

Sir Alexander Creighton, whose situation and station at the court of Russia gave great weight to his recommendations, brought the inhalation of the vapour of tar into more general notice in that extended empire. He was lately at Belfast, and lamented that his mode of recommending that inhalation had been misunderstood in this country. Here, he says, it has been tried by breathing the gas directly as it rises from the heated tar, as they do the vapour of water; but his directions were, to diffuse

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* Dr. Clarke's Travels in Russia.

it through the air of the room, and then the patient could breathe it more or less dilute, as irritability or other accompanying symptoms might indicate.

It would require a volume to contain an account of all the inventions and suggestions proposed for the cure of consumption. We observe, that even the fumes of arsenic and sulphur, were at one time deemed effectual remedies in the worst cases of the complaint.*

Doctor Darwin, whose intelligent mind might have offered a more plausible mode of management, proposed a dusting-box for the purpose of causing powders to be inhaled.

Doctor Saunders, of Edinburgh, recommends the fumes of muriatic acid, and of ether, in pulmonary ulcerations of "*depraved condition.*"

The common kind of frame baths, in which the patient sits upright, as in sulphur fumigations, would not answer in phthisis, or diseases of inflammatory tendency, both on account of the debility occasioned by the erect position, and also the general application of heat to the entire system, quickening the pulse, more than would be sanctioned by propriety.

The sense of the usefulness of vapour fumigation is so universal, that most hospitals are furnished with inhalers, like Dr. Mudge's. It is needless to say they do little good in the manner they are applied.

There should be separate wards for such diseases as require vapour inhalation. Into these the steam should be admitted, in such quantity and so uniformly, as the hydrometer and thermometer would indicate to be at the desired standard, both of heat and humidity.

I think I have shown, in this thesis, that even the air we breath, in ordinary health, does not produce its effects

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* Thos. Willis, Pharmaceut. Rationalis, c. vi. sec. 1.

on the blood, unless when a proper proportion of moisture accompanies it; that dry or anhydrous air only irritates and parches the minute ramified membranous tubes, of which the bulk of the lungs is composed, and that the tissues are not pervious to the natural progress of oxygenation, unless they are moist, and the gas humid. It was already said, that the cellular, mucous, serous, vascular, and other membranes of our system, admit of free filtration, and are permeable to copious percolation *when wet,* but resist absorption, or inhalation, *when dry;* hence it is, that many persons can breathe tolerably well in a heavy or watery atmosphere, who cannot bear to inhale the arid and keen air of places otherwise more healthy.* It may be rationally inferred, that as oxygen is soluble in vapour of water, it may be presented to the blood in our pulmonary branches and air-cells intimately combined with that liquid, and not as dry air. If this idea be correct, it is reasonable to expect, that any other vapour, or medicated medium, presented to the immense surface of the air-cells, (exhibiting a superficies ten or twelve times that of the individual,) should be brought in contact with the coats of these cells, in a state approaching as much as possible to fluidity, in which state, it is well known, remedies are more diffused, generally more potent, and more likely to reach their destination. We observe how copiously the minute odorous particles of flowers are communicated, and rendered sensible to our olfactory organs, when the air is loaded with moisture, which, in

* It was said, in a preceding part of this work, that dry or warm air burns too rapidly when supporting flame. My ingenious and experienced friend, Mr. Nelson, of Glasgow, has, however, taken out a patent for increasing the intensity of furnaces, by supplying them with hot air. In this case it is probable that the heat does not dissipate the vapour, when the air is confined, but expands it, as well as the air itself, of course increasing their force of entering the fire, and conveying to the fuel the caloric which had previously heated them.

a dry atmosphere, or when the membranes are thickened, or parched by a cold, could scarcely be perceived.

> "In climes full of sunshine, though splendid their dyes,
> Yet faint is the odour the flowers shed about:
> 'Tis the clouds and the mist of our own weeping skies,
> That call their full spirit of fragrancy out."*

Besides, it appears to me that there is a condition of the mucous membranes of the air passages and vessels, in certain stages of pulmonary complaints, in which the tissues are preternaturally dry,—either from their texture being altered by cold or excitement, their pores closed, the natural lubricating mucus and fluids dried, or not secreting, and a certain morbid thickening of the coats of the air-tubes taking place, calculated to diminish the calibre of their cavities, as well as to render their tunics less permeable to the air, during respiration. This state of the parts will be much benefitted by inhalation of aqueous vapour, judiciously applied. The old or common mode of drawing in *vapour by the mouth, and cold air condensing it by the nostrils,* was calculated, in many cases, to produce more injury than benefit. After premising the most approved modes of removing or preventing the accession or progress of inflammatory action, the vapour of water should be made the vehicle of communicating such desirable medicinal qualities or principles, as are soluble or diffusible in it. Nor is it the worse than useless method of breathing, for a few minutes, from a teapot, or a tin inhaler, that can benefit. On the contrary, the advantage is derived from the long continued contact of the humid vapour, and the *regulated temperature,* keeping the otherwise dry and parched coats of the pipes bedewed for a *sufficient time,* to enable the alteration in their condition, and the softening in their textures, to begin, and proceed, so far, as to induce a new and more

* Moore.

healthy state of their proximate principles, and a more natural condition of their actions, secretions, and circulations.

But if the simple contact, and more permanent application of aqueous vapour alone, aided by the influence of altered temperature, and disposition of parts, can be so productive of good local effects, when properly applied, both as to time and method, is it not right to infer, that water may be the medium of conveying medicated vapour to internal surfaces, likely to profit from their application? The vapour of water, contained in the atmosphere, will communicate to a man in health as much of the soporific qualities of certain vegetables, if strewed around, as will compose and dispose to sleep. I hope yet to see the day, when some salutary mode of preventing many untoward degrees of pulmonary affections, may be directly exhibited to the parts in danger, through the medium of vapour; many of the primary degrees of disease, in those parts, removed; several of the more advanced, or incurable stages relieved; the ravages of hepatization and ulceration retarded; and, where that termination is unavoidable, the approaches to dissolution smoothed and composed.

The valuable property possessed by Iodine, of subliming where *moisture is present*, below the temperature of boiling water, and of remaining diffused at low degrees of heat, (even that of the atmosphere,) when humid, entitles it to attentive consideration, as a remedy by inhalation. Add to this its well known powers in removing scrofulous affections, and dissipating tumours, rendering the skin more insensible, and pain less acute; giving it claims to minute investigation, as a local remedy in complaints of the lungs of a tubercular, or scrofulous character or disposition, as well as to ulcers in those organs requiring for their cure an altered action or condition.

We should not be deterred from trying remedies by *breathing*, which disagree with the stomach, or *vice versa.* We see how carbonic acid kills, when inhaled, but exhilerates and pleases when drank in water. Iodine is certainly an irritant, and even a poison in its energetic action, when taken into the stomach in *quantity*, but in small doses is employed with advantage. An ounce of it will dissolve in 7000 of water; and its solution has been proposed for internal use, with much reason, as very superior to the water of the sea, which is itself supposed to contain iodine. For these and many other reasons, there is room to hope, that a dilute and well regulated application of its *vapour* may be found salutary in certain ailments of the organs of respiration.

For the information of persons not conversant with chemical matters, some account of *iodine* may be desirable.

Iodine is a production of very humble origin. It is contained in the sea-weed which covers our rocky shores, emitting its smell perceptibly after being wet, and the tide has receded. It is thought that much of the salubrity of the air around the coasts is due to the presence of iodine. No plants or herbs were estimated at less value than the lowly *algæ*, or wrack. Horace makes them the standard of comparison of whatever is trifling and of no account.

"Et genus et virtus, nisi cum re, vilior *alga* est."*

"——— Cras foliis nemus
Multis, et *alga* littus inutili
Demissa tempestas ab Euro
Sternet;"†

Kelp and barilla, both incinerated from marine vegetables, yield iodine. It was discovered and separated, seven-

* Hor. Sat. v. Lib. 11.

† Ode, xvii.

teen years since, by Mr. Curtois, a practical chemist at Paris. Gay Lussac,* Sir H. Davy,† and many others, have since investigated its chemical properties and relations.

Burned sponge, which had been esteemed for ages as a remedy for scrofulous tumours and ulcers, was found to contain a considerable portion of iodine, to which its medicinal quality is attributed, leading to its employment, directly, in these obstinate complaints.

Iodine has been found very efficacious in removing those hideous swellings called "*goitre*," near mountainous regions; and the large glandular condensations which disfigure the throat, named *bronchocele*. Indeed, so very potent has it been found, that it is asserted, on the best authority, such as that of Magendie and others, that a long continued internal use of this medicine has caused the absorption and disappearance of the female mammæ, and other glands. The friction of an ointment composed of a drachm of the remedy, with an ounce of axungia, well rubbed into the submaxillary glands, after being softened by fumigations of its vapours, soon dissipates them, particularly when the tincture is taken into the stomach, diluted largely with water.

The value of this production, as above set forth, when applied to the skin, or, when taken internally, encouraged me to apply it LOCALLY TO THE LUNGS, in place of giving it by the stomach, as hitherto administered, being often disappointed in its remedial effects, when passing through the circulation. Having mentioned this proposal to the distinguished Professor of Materia Medica at Edinburgh, and to several other eminent characters, their favourable opinions induced me to persevere in the trials. Though I sometimes used it in cases where no ultimate hopes of

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* Annal. de Chimie, vol. lxxxviii.

† Phil. Trans. 1814—1815.

recovery were entertained, yet I can affirm it contributed to procure at least temporary relief; and aided, probably by the uniform temperature kept up in its diffusion in the apartments, it never failed to lessen the severity and frequency of the cough, to promote easy expectoration, to diminish the number of pulsations in a minute, and, whether from possessing some soporific property in vapour, or from the comparative ease afforded, there was evidently observed a greater disposition to repose.

Where the pulmonary organization is broken up, and inexorable death advancing, Iodine will be but a weak defence against that remorseless enemy. But, even then, ease and tranquillity are objects of great value; and when they can be enjoyed, the prolongation of life, even for a short period, is affectionately wished for by the patient and the friends.

What its effects are, when pulmonary destruction has not advanced so far, will be glanced at, when we come to speak of the influence of fumigations in consumption. Whatever its merits may be, they are cheerfully submitted to the tribunal of public investigation. If a life can be saved, or if in a single instance the pang of parting from a beloved parent be prevented, then my hopes and anxieties are abundantly rewarded.

In using the apparatus represented in the plate, and when a cup, tube, or vial, containing moistened iodine, is placed in the stream of vapour, the iodine sublimes in beautiful violet exhalations, from which the substance itself derives its name.* I mention this, because I knew a young lady, a patient, very much alarmed when she saw the vapour approaching her breath, purpled almost like the ominous colour of blood.

In places where the vapour is not observable, holding

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* Ιος, *violaceus,* and ειδος *forma.*

a spoon, wet in starch and water, near it, soon turns the starch blue, and is a proof of its rising in the room.

In this trial the heat must not be high, and the iodine requires to be simple, or uncombined. I have noticed that the vapour of iodine, mixed with that of water, tinges a silver spoon gold colour, then dark. In summer, or where it is not advisable to keep the apartment warm with the boiler, a small cup of moistened iodine, set in a bowl of hot water, elevates abundance of the medicine through the air about the bed. It is less liable to decomposition in this way, than when mixed in water in a tin or iron boiler, where a sediment, like damp or wet rust of iron, soon subsides.

It is so easy to keep the air of a room, in which vapour of water is diffused, so impregnated with iodine fumigation, that there is less necessity for resorting to any of its compound vapours. The gas, however, which is a component of hydrogen and iodine vapour, called *hydriodic*, could be easily diffused, in dense white clouds, from water charged with it. This, also, would saturate the atmosphere of an apartment, without the aid of artificial heat. Where there is the hectic flush, and undue evolution of animal caloric, and when the palms of the hands feel much hotter than they really are, a wide mouthed vial of moistened iodine, grasped in the hand, abstracts its fervid temperature, and, at the same time, supplies the breath with abundant odour of the shore. A thousand other means of diffusing the fumes of iodine present themselves: a vial, a cup, or a glass tube, containing wet iodine, if suspended in the jet of steam, as it leaves the orifice of the pipe, will spread the vapour far and wide. In this manner a stream of it can be directed by a thin glass pipe, over the patient's face in bed, its great specific gravity causing it to fall and be inhaled. An atmosphere of iodine vapour, and that of water mixed with air, can be regulated to such strength as the patient finds agreeable. Such an apartment instantly reminds you, on entering, of the smell arising from kelp kilns, when burning marine vegetables along the coasts.

If the statement of our respected friend, Mr. Greenfield, be proved correct, that an atmosphere of chlorine gas and vapour of water prevents consumption, among his paper makers, a class of persons most of all obnoxious to that complaint, from their confinement, part of the day, in thick clouds of dust in a rag-loft of the paper-mills,—if chlorine and steam, dissipated through the works, can prevent phthisis, is it not reasonable to suppose, similar means might contribute towards the cure of persons who might have contracted the complaint? Would not, therefore, the junction of chlorine gas, and that of iodine, be a rational proposal, regulated, of course, according to the different degrees of the disease?

When speaking of *iodine inhalation*, I may observe, that it might be supposed more advisable to delay its publication, until a greater number of certain proofs of its efficacy could be adduced. But believing, as I do, that its proper management will produce beneficial results, I considered it my duty to take the earliest opportunity of having its medicinal value, *in this new mode of exhibition*, brought sooner and more extensively to the test of experience. If my mode of administering iodine be useful, it will be the more so the earlier it is applied. Not only should concealment be avoided, but the very suspicion of it. It is the part only of a quack, or an empiric, to obscure or keep private a new method of cure, as a miser does his gold. Publicity is useful, for this reason, that a man may entertain opinions of a plan or a practice introduced by himself, much more favourable than that to which they should be entitled in public estimation. We are not the best judges in our own cause.

No doubt the anxiety for success, and the particular care in conducting a process, and watching and regulating its effects, will cause it to succeed in the hands of the inventer, when it might fail under less careful management. But, at all events, the wider any novel proposal is circulated, the sooner and the surer will its merits be decided.

Narrow headed men, with narrower minds, will whisper obstacles, and nod condemnations, a most marked instance of which I lately met, and shall delineate, in my next edition, as an example to other *vis a tergo* oracles.

A medical man who superciliously condemns a new proposal, though rational, and highly recommended, and who pronounces without inquiry, or any opportunity of seeing or judging what he advises others to reject, must be contracted in his ideas, and careless of the advantages of his patient, or the advancement of his profession.

With such conduct, of which few only are capable, it is consolatory to contrast that of the gentleman, and the enlightened physician. Doctor Thompson, on being asked by the anxious friends of one of his patients, (long confined with severe cough and pectoral complaints,) regarding the propriety of using the iodine inhalation, of which they had heard so much, applied to me, accompanied me to the bed-side of an amiable young lady, who had been breathing an atmosphere of warm vapour and iodine, diffused through the apartment, for some months. Here he saw the entire process, and the progress of the patient, and was then able to give an opinion from the evidence of his own observations. He at once recommended the adoption of exactly similar means, to his much respected patient. Whatever the results may be in this interesting case, great relief was soon experienced from a most vexatious cough, and the frequency of the pulse was considerably diminshed. Doctor Thompson further suggested, what is important to keep in mind, that this estimable lady should be provided with two iodine boilers, lest, in case of accident to one, the patient should suffer from reduction of temperature, and want of the vapour, she residing at a distance from workmen, and could then in a moment resort to the other vessel.

This judicious caution was given, because, on a similar occasion, a patient suffered severely by an interruption to the diffusion of the vapour during a few hours, when the steam-vessel was repairing, after being corroded by the iodine.

Patients confined in an atmosphere in which warm vapour is diffused, suppose they perspire much more copiously than they really do. If the vapour be near the face, the condensation of some of it moistens the skin. This, as well as the quantity of water in the air, prevents the evaporation of the perspired matter from the surface, so that a patient will certainly appear to perspire more in such an atmosphere, than in a dry room heated by a parching stove, or a scorching fire.

Let a man with tender or ulcerated palpebræ or eyelashers, judge of the noxious nature of hot air. If he sit with his eyes open a little time, in a current of wind, or before a fire, even though the light be shaded, he instantly feels the pain, itching, harsh dry heat, and general uneasiness of the parts incalculably aggravated. Let him then expose the open eyes over copious vapours of some soft demulcent vegetables and water; so soon as that liquid begins to condense on the sores, so soon does he experience relief.

Upon examining the gradual and almost mathematical precision, with which the temperature of a stream of fumigation can be directed to any part, and regulated in degrees according to the distance from the mouth of the pipe, and its calibre at the orifice, it appears applicable to many purposes and modes of being conducted to any affected portion of the surface of man, and could be acting upon it during operations, or medicinal applications of any kind.

In climates where the air is very dry, evaporation from the body proceeds so fast, that the people seldom seem to sweat at all.

The injuries resulting from open fires, with their dust, and unequal distribution of heat, are incalculable in chambers where phthisical patients are confined.

Stoves, such as those introduced by Count Rumford, diffuse more uniform warmth ; but they dry the air too much, and occasion an unpleasant metallic smell. Steam confined in pipes, and passing away in them, heats the air as it does in a drying loft. It ought to be admitted loose and unconfined into the apartments of the con sumptive. It should be generated in an adjoining room, during warm weather.

The use of coal fires, in place of wood, has been accounted a cause of the great increase of consumption in these countries; but I believe the proportion holds equally in districts where turf only is consumed.

Breathing air, when very cold, produces inflammation in the nose, fauces, trachea, and bronchiæ. As exposure to the sudden heat of a fire might be dangerous, it is more reasonable to expect that the diffusion of warm steam in the apartment would gradually accommodate the fine vessels and tunics to the transition, and thus prevent disease or disorganization, on the principle alluded to in the last chapter.

But inhalation of vapour has several advantages more than those of prevention, as above stated. Even in advanced pectoral affections, such as ulcerated lungs, or diseased mucous surfaces, the volume of aqueous vapour taken in, lessens the proportion of atmospheric air presented to these parts. When they are denuded, parched, or inflamed, air affects them as a very active stimulus. Its perpetual renewal, at each inspiration, produces, by its frequent contact, injuries, which its more diluted or attenuated introduction would be less likely to accomplish. Therefore, if you inhale vapour, which condenses in the cells, at least a small part of it, it bedews and covers the surfaces and ulcerations, by which means you exclude the application and arid excitement of the dry air. You do more:—If you inhale ten inches of artificial vapour of water, mixed with ten of atmospheric air, you go far towards warding off the irritation of the latter from the moistened membranes *and superficies of the sores.**

It is incredible the quantity of watery vapour that may be taken into the lungs; a patient will inhale it during four hours, through a close bag, appearing to admit little atmospheric air. I was often surprised how much moisture the surface of the lungs can bear, without much sense of suffocation; but having lately come to the knowledge of the experiments of Professor Mayer, of Bonne, my former views on this head were fully confirmed. These experiments show how reasonable, and compatible with safety, is the inhalation of vapour, as about to be recommended in one of our succeeding chapters on phthisis. The valuable information conveyed to the student, by the result of Professor Mayer's experiments, encourages me to submit them to my young friends. Those who have Richerand's work, will find the matter set forth in

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* *Twenty inches* is probably nearer the quantity of air inspired each time, *than forty*, as was estimated, page 97, on such general and respectable authority. Professor Thompson (the best evidence) computes it about sixteen inches.

Dr. Copeland's excellent notes to the translation, page 605.

In this quotation, pulmonary imbibition is so well elucidated, that it renders any disquisition on that head unnecessary.

"OF ABSORPTION IN THE LUNGS.—Professor Mayer, of Bonne, infers, from experiments instituted in order to ascertain to what extent absorption takes place from the lungs:

"1°. That animals support a considerable quantity of liquid injected into the lungs, without experiencing mortal symptoms from them; but these injections should be performed by an opening made in the trachea.

"2°. The symptoms of suffocation, which arise from injections, are not serious when we inject pure water; but they become so when thick fluids, for example, oil which obstructs the aerial passages, or some chemical solutions, which inflame the bronchial surfaces, are employed in this manner.

"3°. The fluids and solutions injected into the lungs are absorbed more or less quickly according to their nature, and their degree of concentration.

"4°. This absorption is in general very great, but is less in young and newly born animals than in adults.

"5°. Absorption takes place by the pulmonary veins, for it has occurred in the space of three minutes; the fluids injected are found in the blood before they are perceived in the chyle; they are found in the left auricle and ventricle of the heart, long before the least trace of them can be seen in the right auricle. Lastly, absorption is carried on even although the thoracic duct be tied.

"6°. Absorption is likewise performed by the lymphatic vessels, but more slowly.

"7°. The veins of the stomach and intestines also absorb, but in much smaller quantities.

"8°. The existence of fluids absorbed by the veins, can be demonstrated in the blood. It is easy to discover there the prussiate of potass, the muriate of iron, arsenic, &c. The prussiate of potass injected into the lungs can be traced, first in the arterial blood of the heart and arteries, then, if the injection be continued, in the venous blood.

"9°. These substances can be discovered in abundance in the urine in bladder, and in that in the kidnies. The prussiate of potass can be discovered in it seven minutes after the injection.

"10°. The prussiate of potass is likewise deposited, and even in considerable quantity in the serum of the pericardium, of the pleura, of the peritonæum, in the synovia, under the skin, and in the milk.

"11°. When the prussiate of potass is injected, it can be discovered after some hours, not only in the fluids, but also in many of the solids: several of these parts then become green or blue with the muriate of iron, viz. the cellular tissue under the skin, and in the whole body, the fat, the serous and fibrous membranes, the aponeuroses of the muscles, tendons, the dura mater, periosteum, &c.

"12°. The membranes of the arteries and veins; even the valves of the heart can be thus entirely coloured blue by the same agent.

"13°. The parenchyme of the liver and spleen cannot be coloured blue, but sometimes the cellular tissue around their great vessels. The lungs, the heart, and the kidnies can be coloured blue.

"15°. The substance of the bones and their marrow, the substance of the muscles and that of the brain, spinal marrow and nerves, evince no change of colour with the muriate of iron. The nerves of the brain and spinal marrow seem to exert a repulsive and exclusive force, on the contact of fluids foreign to their nutrition. It may be concluded from this that the opinions of many physiologists, that poisons act mortally, when they are applied to these parts of the nervous system, are not well founded, and are devoid of direct proofs.

"16°. These experiments may also throw some light on secretion, the reproduction and nourishment of bodies; they teach, moreover, the passage of liquids from the mother to the fœtus. When the prussiate of potass has been administered to the mother, it can be detected in the water of the amnion, in that of the chorion, and of the umbilical vesicle, in the liquid of the stomach, in many solid parts of the fœtus, for example, in the kidnies, in the stomach, &c., as also in the placenta. When a fœtus, to the mother of which prussiate of potass has been given, is placed into a mixture of spirit of wine and muriate of iron, it becomes blue coloured. Thus we acquire a certain proof of the passage of fluids from the mother to the fœtus, a proof that has been vainly sought for until now:---the fluids taken into the blood of the mother are deposited in the tissue of the placenta, and are thence absorbed by the veins of the fœtus."

It may be objected, with some appearance of reason, that if, according to the *hypothesis* ventured by me, the small quantity of vapour we inhale from the air can contribute so largely to the production of animal heat, it would be much too copiously set at liberty, if we inspired volumes of dense artificial vapour. This objection would be valid, were much of the inhaled steam condensed either into water, or solid hydrates. In either case an excess of temperature would be produced, as happens in fits of fevers, when the tissues and elements are in a condition calculated to convert the vapour from the air into water, which soon escapes, or should escape, at the skin, as we observe in hot fits of intermittents; or as occurs in inflammatory diseases, when consolidation takes place into solid hydrates of fibrine, and other sthenic principles, rapidly generating from some fluid constituents. But when we inspire a column of steam and air to fill the vacuum of the chest at the time of inspiration, and when that vapour is emitted at the expiration, in the same state as when taken in, no caloric of vapour is set at liberty.

No doubt, the colder air of the apartment meeting the steam, will cause a deposition of water, when entering the mouth and nostrils; and further, owing to the difference of temperature, a minute portion will form water in the air-cells and pipes, of course liberating some heat, which of itself is a reason why, in acute inflammations, active depletion should precede or accompany warm inhalations. But when the membranes are saturated, and the temperature of the steam little altered, then there is not much deposition or appropriation of water in the tissues, and, consequently, little liberation of latent warmth more than in natural respiration.

But, with regard to common breathing, as was said before, *when we inhale cold vapour in air, we exhale warm water in the breath;** for the halitus which we expel, as well from the lungs as from their outlets, leaves them, not in *real vapour*, but in nascent spherules of *real water*, spherules widely dispersed, and separated, borne along in the exhaled air, and not yet conjoining into drops, but minutely diffused, just as aqueous mollecules, so extremely minute as to be specifically lighter, are carried along, or supported in the atmosphere, as clouds.

It is in the same way, that the vapour which pervades the cavities and serous surfaces, (mentioned page 91,) when it liberates its caloric, deposits a corresponding portion of its water; but, like that in the breath, in such small spherules, as to be almost instantly absorbed, so that the serous sacs seem, on being opened, to contain only a light cloud.

It is the due ingress of *vapour*, and egress of *water*, which appears in a great degree to keep up the uniformity of temperature in health, when the former is naturally converted into the latter. It is the interruption to this conversion which occasions the coldness attending dropsies, when the spherules of water, not being ab-

* Page 111.

sorbed, run into drops, accumulate in the cavities, abstract the heat, which should be distributed to the tissues, and prevents the healthy progress of the diffusion of caloric, where the above-mentioned source is interrupted. Add to this, that in such complaints where there seems to be a condition disposing the solid elements or principles to run into fluid ones, there will be (at least as far as their constituent water is concerned,) a quantity of caloric rendered latent, and as it will be abstracted from the surrounding animal particles, *cold will be produced* by the withdrawing of this caloric of fluidity, which the water, in the state of solid hydrate, did not require. When such particles are accumulating and forming the mass of some sudden tumour, or large inflamed swelling, heat proceeds in proportion to the extent of such deposition; but when this untoward aggregation of *solid* elements begins to run into *fluid*, and form pus, then shiverings and coldness accompany the transformation. Thus then, when *sthenic* particles are changing into *asthenic*, *cold is the consequence;* and, on the contrary, when liquid asthenic elements run into solid or sthenic ones, heat is evolved.

Some such conversion and reconversion, must at least proceed when periodical or diseased states of the system determine the undue proportion of fluid particles causing cold fits, and again of solid in hot exacerbations: for if heat and cold depended *directly* on respiration, as an *oxygenizing* medium, such sudden and very different degrees of temperature would not take place; because, in hot or cold stages, respiration goes on, differing a little, probably in the quantity of air inspired, but not so as to account for a cold fit of an ague one hour, and a hot one in the next.

With regard to the terms and hypothesis here adduced, it is surely more innocent to indulge this idea as a *ratio* *morborum*, than Brown's beautiful but nocuous doctrine of his *ratio medendi*.

Another objection arises to fumigation, from the degree of dampness it produces on the curtains and bed-clothes. The deposition of water, like *dew*, will settle on every thing, from vapour, when they are cold; and this is certainly objectionable, where fashion or prejudices prevent the removal of the curtains, as, in that case, the pipe conveying the vapour cannot so well be introduced over the patient, for, no doubt, the curtains would soon be saturated with moisture. But as our chief object in phthisis, during winter, is to maintain the heat of the apartments from 60° to 70°, there is the less occasion to keep the patient warm by any close covering around the bed. Besides, I must say, that I never yet saw any harm resulting from warm damp, when a constant supply of heat was contributing by the hot steam from the pipe. It is cold damp which injures, because the caloric it takes, to convert it into vapour, is abstracted from the body; whereas, that which evaporates warm moisture, is taken from the hot steam of the room, so long as it continues to be regularly supplied.

As this process is only calculated for cold seasons, and phthisical patients, their surface being often feverish, feels better for a little abstraction of heat. In such cases, where there are hectic flushes, you can regulate the temperature of the apartment so as to reduce it a few degrees in as many minutes, merely by surrounding a piece of the vapour pipe with a towel loosely wrung out of cold water. The steam will condense on reaching this part of the pipe, and run back in drops into the boiler, and the air of the room will soon begin to cool.

The vapour of digitalis, poppy heads, hyosciamus, belladonna, thorn-apple, &c. &c. all merit careful trials in cases of tracheal, bronchial, pleuritic, and other pectoral affections, aided, as their influence would certainly be, by several hours' alteration of temperature and moisture.

The inhalation of very pungent vapours, long recommended, were found injurious, on account of the acrimony and excitement they produced,—irritating, rather than soothing. But the vapour of *medicinal or demulcent substances,* when diluted and rendered mild by that of water, can be regulated so as to appease and allay uneasiness in all incipient excitements.

> "Sunt herbæ dulces: sunt quæ mitescere flammam
> Mollirique queant."

That Providence, which ordained for man, some vegetables for food, and some for physic, placed each almost within his reach. When we consider the boundless abuse and misapplication of internal medicines, we may confidently declare, that every clime and country would be, in the aggregate, more safe, if confined to the external use and mode of administering the productions locally furnished by nature, and suited to every place. But the error, which extended so widely, of *swallowing* all remedies, instead of locally *applying* them, caused their topical effects to be neglected, or brought into disrepute or desuetude. Add to this, the desire for expensive and foreign medicines, and also the commercial views and recommendations of those, whose aggrandizement is enhanced by their manipulation and production.*

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* "Hæc sola naturæ placuerat esse remedia parata vulgo, inventu facilia, ac sine impendio, ex quibus vivimus. Postea fraudes hominum et ingeniorum capturæ officinas invenire istas, in quibus sua cuique homini venalis promittitur vita. Statim compositionis et misturæ inexplicabiles decantantur. Arabia atque India in medio aestimantur, ulcerique parvo medicina a Rubro mari importatur, cum remedia vera quotidie pauperrimus quisque cœnet."—*Plin.* l. 24. c. I.

CAP. XIV.

AUXILIARY AGENCY OF WARM BATHS AND VAPOURS IN THE TREATMENT OF DISEASES OF THE MUCOUS MEMBRANES.

NOTHING can be more justly offensive to the enlightened physician or surgeon, than to see one or two remedial medicines, or measures, extolled or recommended in a great variety of complaints. For, as Dr. Mead well observed, if a remedy be potent, it has the power to do good; and if it be injudiciously resorted to, will possess the property of doing harm. *I wish, therefore, once for all, to impress on the reader's mind, that the recommendations here advanced are urged* only *as preparative agents,* disposing a part, or the whole system, towards a more salutary state, and rendering its elementary principles more susceptible of those changes, which the practitioner may desire to induce, by any other additional means he may select.

Bathing and *fumigations,* as manageable media of *heat* and *moisture,* are good *preventive measures,* but are, by no means, offered as *exclusive remedies.*

Having now come to speak of the practical part of our subject, namely, the diseases most likely to be modified, alleviated, or removed, *by the auxiliary agency of warm vapour, or warm baths,* we will advert to a few of those complaints affecting the several membranes or tissues, to which the influence of topical temperature and humidity can more directly extend. We do not here attempt a regular or systematic arrangement, or enter on the wide field of nosological distinctions. We must also decline, for the reasons set forth, (page 130,) to enumerate the genera and species of the great class CUTANEÆ. A treatise on the advantages and effects of temperature and moisture on each of these affections, would extend to a very large volume.

When we consider the anatomical structure and functions of the skin, and the various diseases originating and seated in its different parts or substance, or on its outer or inner surface; when we observe the visible alterations produced on its papillæ or vascular eminences, on its folliculi or minute sebaceous glands, or rather sacs; when we reflect, that the tissue is almost made up of gelatine, on which heat and dilution so potently act, we can easily conceive how powerful will be the long continued contact of warm aqueous media, so effectually and immediately applied to the entire tunic itself. This gelatine, when in the shape of glue, formed by boiling skins and membranes containing it, will hold two boards, joined, with such tenacity, that the solid wood will separate sooner than the joint; but expose the space, thus glued together, for a short time to a current of steam or vapour,—the gelatine soon softens, looses its cohesive properties, and the boards instantly separate with ease.

Did time and space permit, it would be easy to show how valuable would be the aid derivable from the promotion of diaphoresis and determination to the surface, in all that character of complaint seated in the outer or cuticular surface, such as measles, scarlatina, rose, and, in fact, all the rashes.* Mild diffusion of moisture, or warm vapour, elicits these exanthemata to the surface,

* Bichat. Craigie.

and are agreeable to the patient, and serviceable in promoting the subsequent desquamation.

Every person has observed the utility of Poultices, which are but continued fomentations to a particular inflammation in the cutaneous texture, called phlegmon, the heat either assisting in its resolution and dispersion, or, if that cannot be effected, accelerating the condition which determines towards healthy and speedy suppuration.

With respect to those very obstinate, and sometimes dangerous disorders, forming in the substance of the skin, opening at the top, and pouring out a scanty drop of bad sanies matter, oozing as if from the root of each hair. This distressing *anthrax*, or *carbuncle*,* occasions such tension, burning, and general suffering, as sometimes, when it extends rapidly, to prove fatal. I have found, that directing a copious stream of warm vapour on the sore, and the surface around it, fatigued the excited vessels of the tumour, softened its substance, took off the sensation of stretching from the skin, diluted the acrimony of the ichor, promoted an improved discharge, and obtained rest and relief. When the pain was very violent, opium was boiled in the water giving out the vapour. *After free incisions* through the entire mass, the above process, if continued sufficiently long, insulates the disease, prevents its progress through the cellular membrane, and promotes abundant escape of pus, and separation of the dead skin and sphacelating tissues of subjacent fibres.

The consideration of the *squamosæ*, or scaly and inveterate cutaneous complaints, commonly called, by way of pre-eminence, *diseases of the skin*, such as lichen prurigo,

* Melancholy ravages were committed by pestilential malignant carbuncles, in England, in 1666.

or itchy rash, scaly lepra, tetter, fish skin, psora, scabies, tinea, or scald head, impetigo, though evincing many varieties, yet being amenable to vigorous and determined perseverance in fumigations and chlorine gas, I refer, for the treatment of these affections, by sulphureous vapours, to the works of J. E. Gales, Paris, 1816; Jean de Carro, Vienne, 1819; M. de Arcet, 1814; also, observations on sulphureous fumigations, by Wm. Wallace, Esq. M.R.I.A. Dublin, 1820.

Passing over the other parts of this extensive subject, I beg to direct attention to the following facts, reported by a Medical Committee at Paris, in 1814. The importance of this document encourages its quotation and circulation as widely as possible*:—

"The number of fumigations administered to each patient varied according to the inveteracy, the species, the complication of the disease, the constitution, the temperament, the age, and the sex of the patient.

"One patient was cured by five fumigations, another required six. Five have been cured by seven fumigations each, two by nine, four by ten, one by eleven, seven by thirteen, four by fourteen, four by fifteen, eight by sixteen, one by eighteen, three by twenty, one by twenty two, one by twenty four, one by twenty six, one by twenty eight, three by thirty; finally, a dartrous patient, who was *radically cured*, required *seventy*.

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* To the Committee proposed by M. Morguê, Inspector of the Hospital St. Louis, and member of the general administration of the Civil Hospitals at Paris, the following eminent men were appointed:—

The Chevalier Pinel, Member of the Institute, Chief Physician of the Hospital of Salpetriere, and Professor to the Faculty of Medicine; Baron Dubois, Professor to the same Faculty; Esparon, first Physician of the third Dispensary; Tartra, first Surgeon of the first Dispensary; and Bouillon-la-Grange, Doctor in Medicine and Professor in Chemistry; were constituted members of of the jury.

"Females and infants, ceteris paribus, required a smaller number of fumigations than adult males, and particularly than old men.

"The entire number of patients cured, who laboured under dartres, required two hundred and eighty three fumigations; which, divided among the whole, gives the average to each individual of thirty fumigations.

"The patients labouring under scabies received six hundred and five fumigations; thirteen the average.

"Two patients labouring under prurigo, received eighteen fumigations: nine each.

"Sulphureous fumigations had a peculiarly remarkable effect on old, inveterate, complicated, and obstinate scabies, curing it proportionably quicker than recent cases.

"A patient labouring under tinea received four fumigagations.

"The number of fumigations administered to each patient does not give the number of days required for his cure; many of them having received three, and even four fumigations daily.

"The nine dartrous patients, who were cured, required one hundred and twenty days for their treatment; which makes thirteen days the average number for each.

"The forty three patients labouring under scabies required three hundred and twelve days; on an average, seven days to each.

"Each patient labouring under prurigo, required twelve days for his treatment.

"The patients labouring under scabies, and other cutaneous affections, submitted by the jury to sulphureous fumigations, were, in general, subjects in whom the disease had advanced to the highest degree, and possessed the most obstinate characters.

"All the forty three patients labouring under scabies, obtained a cure. Nine dartrous patients were cured, and three were relieved; the porriginous patients were in progress towards cure; and the two pruriginous patients obtained a radical cure.

"CONCLUSIONS.

"1. That sulphureous fumigations cure perfectly every kind of scabies, even the most inveterate.

"2. That the number of fumigations requisite to cure scabies varies from four to twenty; according to the age and sex of the patient, and to the intensity, the species, and the complication of the disease.

"3. That females and infants, ceteris paribus, require a smaller number of fumigations than adult males, and particularly than old men.

"4. That old inveterate cases of scabies are cured proportionably more quick than recent cases.

"5. That the length of time required for each fumigation, is ordinarily about half an hour.

"6. That patients may take even four fumigations daily; according to their temperament, their leisure, or their anxiety to obtain a more or less rapid cure.

"7. That the treatment of scabies, by sulphureous fumigation, does not require any auxiliary treatment, either internal or external; nor any sort of particular regimen.

"8. That, compared with all other known modes of treatment, even with those that are regarded the most rational and the most efficacious, such as sulphur ointments, mercurial ointments, mercurial lotions, arsenical frictions, lotions of tobacco, baths of sulphuret of potash, &c. &c. the treatment by sulphureous vapour appears to excel very much in simplicity, brevity, innocence, and efficacy.

"9. That it is also much less expensive than any of the others.

"10. That various other cutaneous diseases, such as pedicular affections, prurigo, tinea, dartres, even inveterate and regarded as incurable, are susceptible of yielding to sulphureous fumigations.

"11. That, in general, other chronic eruptive diseases require a greater number of fumigations than scabies; but that this means should always be regarded at least as an auxiliary, in the treatment of these diseases.

"12. That it is of the greatest importance to make known the advantage of these fumigations, to propagate them, to establish them in hospitals, on board vessels, in camps, in barracks, in prisons.

"(Signed,) PINEL, A. DUBOIS, A. E. TARTRA, ESPARON, and BOUILLON-LA-GRANGE.

"Seen and approved,

"(Signed,) MOURGUE."

CONSIDERING the foregoing document, sufficient to direct attention to the extensive field of CUTANEOUS DISORDERS, already amply elucidated by others, we will now speak of such affections of the MUCOUS MEMBRANES, as are within reach of relief from the *applications* here recommended. From what was said, (page 153,) it will appear, that complaints of these tissues are, next to those of the skin, most amenable to the direct influence of the emollient preparatives, of which we are discussing.

Our observations embracing only a *particular* department, we leave to *general* writers descriptions of the two great divisions of the mucous coverings. The *gastro-pulmonary*, lining the various orifices of the face; the alimentary canal, and bronchial ramifications, or the *genito-urinary*, covering the internal surface of the bladder, or rather itself being that coat, as well as of its passages, and those of the neighbouring organs. Passing over the anatomical consideration of these lining tissues, we at once advert to their diseased conditions, which complaints, on account of their *seat and nature*, we venture to range under the class MUCOSÆ.

If a dissertation were contemplated, comprehending all the varieties of the affections of these coverings, and if systematic modes of treatment were recommended for each, then it would be necessary to subdivide and distinguish the *orders*, *genera*, and *species*, of the complaints of the mucous coats, according to the state and place of the disorder, or the change of structure and altered secretions of the tunic itself. As the plan of cure would be necessarily varied with the alteration of the fluids thrown out upon the soft surface of the membrane, then practical indications would point out the propriety of some such distinct designations as would embrace diseased albuminous discharges, when fluid of that quality would predominate; purulent, when suppurative inflammatory action prevailed; and so of any other altered state, such as tubercular, &c., to which lesion of these membranes may give rise. Though " a rose will smell as sweet by any other name," yet it might occur, that, for nosological purposes, orders of the class MUCOSÆ, might be usefully arranged along with their genera and species, in one defined division of diseases, peculiar to the structure of which we are now discussing.

The first division of inflammation, or *dry states* of these membranes, where the natural secretion of mucus is suppressed, might derive a designation from its *absence.* To avoid confounding terms similar to the latin name of the class itself, a Greek appellative, such as ABLENNOSÆ,* or *want of mucus*, might be chosen.

The second condition, requiring a higher degree of ac-

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* Α, *non*, ΒΛΕΝΝΑ, *mucus*.

tivity in local applications, might, from the copious increased discharges of albuminous mucus, be defined, as a subdivision, under the title "ALBUMINOSÆ."

The third degree, or suppurative inflammations, demand general and topical treatment, and regimen, different from the two former,—therefore, a denomination, such as "PURULENTÆ," ought to embrace all such alterations of the mucus surfaces.

Some modification of such a nomenclature, would direct our devious steps more clearly than a classification, which starts with one great denomination of our chief diseases, under the appellation of "PYREXIÆ," from the Greek word *fire.* Then, because this class contains "Greek fire," of course there must be some burning in the business, and its hottest and most extensive order is named "PHLEGMASIÆ," from another Greek word signifying to burn. This Greek is a most talismanic tongue. If an English or Latin epithet can convey neither meaning nor explanation of a thing, then we discover a definition perfectly intelligible to the meanest capacity, in some *Attic* nomination.

Though there is no doubt but the "*local habitation*" would best confer the "*name*," yet as we cannot be expected to do great things in small space, we must refer to Bichat, Craigie, and those who have anatomically treated of the animal tissues, and particular textures of the body.

We have, moreover, the less occasion to establish explicit and well defined differences between each separate set of symptoms; because, so far as *our subject* is concerned, we have to offer but simple subsidiary means of softening and soothing the villi and mucous tela, and disposing it to a new and altered condition, susceptible of such improvements, by additional modes of relief, as proper discrimination may dictate to the practitioner.

Having now passed over the *Cutaneæ*, because abundantly alluded to by others, the first of the *Mucosæ*, or inflammatory diseases of the mucous tissue, to which we advert, is inflammation of the conjunctiva or external coat of the eye, and its palpebræ, which complaint is commonly called OPTHALMIA.

Opthalmia.

A MAN travels on the top of a coach, or on a car, during a damp cold night: next day he rubs his eye; thinks it is irritated by sand or dust, it cannot be opened so easily as before, and feels contracted and smaller, especially in the light of the sun, or a candle. With itching and heat there is a darting pain, and a sense of heaviness and inability to move the eye. The temple and side of the head affected, feel stiff, pained, and beating, which sensations are increased on stooping. On examining the lining of the lids and eye, after the inflammation has advanced, the colour of the conjunctiva is deeper red, owing to a greater quantity of red globules in the vessels, and the membranes themselves appear thickened. On attempting to open the eye, scalding tears run over and irritate the cheek. These symptoms, with a disagreeable obstruction, or stoppage of the nostril of the affected side, give a general outline of the first stage of membranous opthalmia.

After this, if no proper antiphlogistic treatment have been adopted, numerous drops of thin mucus appear, which become thick and cohesive, as the disease advances, so as to keep the eye closed, particularly on awaking from sleep. This progress of the complaint involves contiguous parts: the head-ach increases, light becomes in-supportable, and vision sometimes indistinct; certain habits and conditions dispose to an extension of the disease to both eyes.

After the second, a third, or more chronic stage succeeds, if the former have been neglected, or ill treated. The margins of the eyelids become thick, rough, red, and purulent; the general pain and irritation abate; the tears and matter are discharged. When the inflammation involves the sclerotic coat, the patient cannot read, particularly with candle light; the turgid vessels become more flaccid on the eyeball; and, when the cure is tedious, white specks of coagulable lymph begin to swim, like small eclipses, before the cornea.

Transparent membranes predominate in the eye,* and as they soon partake of inflammation, serous discharges mingle with the mucous or albuminous; these mixed secretions are very liable to coagulate, and form specks and thickened lymph. We see this evinced in croup, where the sub-mucous membranes, being fibrous, throw out serum, and the mucous tissues secrete albumen, both combining to form the adventitious coagulated tube.

During the first stage, along with leeching, saline purgatives, venesection, diaphoretics, and such other medicinal treatment, as may be professionally employed, the sufferer will find the greatest relief from the long continued relaxing contact of tepid watery vapour, raised from a decoction of chamomile flowers, belladonna, digitalis, poppy heads, or any emollient vegetable, and then washing the eyes with the warm liquor itself.

Any of these fomentations is put into a large basin, or jug, and placed on a table. The patient leans his fore-

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* "Quis vero opifex preter naturam, qua nihil potest esse callidius, tantam solertiam persequi potuisset in sensibus? quae primum oculos membranis tenuissimis vestivit et sepiit; quas primum *perlucidas* fecit, ut per eas cerni posset; firmas autem, ut continerentur."—*Cic. de Nat. Deor. l. 2. c. 57.*

head over the vessel, on a pillow or cushion, allowing the vapour, at an agreeable heat, to ply on the open eyes. The temperature of the fumigation is to be raised from time to time, but not so high as to give pain. The head is covered with a cloak or mantle. This confines the vapour about the head and eyes; and this plan of treatment must be persevered in for several hours, if speedy recovery be expected, and judicious depletion have been premised.

The advantages of this auxiliary to the other methods of arresting opthalmia, during its first stage, are:—

1. That it confines the patient under necessary restraint from light and air, at a time when it is essential to enforce that salutary regulation, and to avoid exercising the organ.

2. That where leeches have been applied to the temple, or under the eye, confining the part over warm vapour is the surest mode of abstracting plenty of blood, during long continued fomentation.

3d. That the same process greatly assists the indications of diaphoretic medicines, inducing relaxation of surface, and disposition to free perspiration, which is the more requisite, when, from the violence of the disorder, or unskilful treatment, a febrile disturbance of the whole habit ensues.

4. That keeping the head high, or erect, such a length of time is beneficial, where there is beating or pain in the temples.

5. That the tension being removed from the vessels, the surfaces bedewed and softened, the pores opened, and the vascular system reduced to a favourable condition, must assist such other remedies, as may be prescribed, for producing a more natural and less obstructed circulation in the membranes.

Add to this, that the vapour, condensing on the eye, washes off the acrid discharge, and removes the sensation of gritty particles from that organ. There is a distinction between the dilitation of the vessels of the mucous membranes, and those of the *serous;* the former are superficial, and extensible without controul; those of the latter are in contact with, and supported by, some other opposing surface, preventing their undue distension.

The serous membranes are tense, and therefore the calibre of their vessels remains firm and uniform; whereas, the mucous tissues are soft, and in loose folds and rugæ: hence, on any sudden impetus of blood into a part, or what much oftener occurs, on any interruption to its exit, the arteries, but more often the veins, become tortuous and over-distended, having no fibrous support to prevent their dilitation. Therefore it is, that after the removal of acute pain, the application of astringents is beneficial, not so much, as is commonly supposed, by constringing and lessening the vascular diameters, as by contracting the membrane on which they spread, and imparting to it tone, firmness, and tension. It is in such cases that the medicated oil, mentioned, (page 22,) is valuable as a remedy, particularly estimable for medicinal advantages to mucous surfaces. It deserves the greatest consideration to observe how much the administration of medicines, capable of improving the condition of one mucous membrane, particularly that of the stomach and bowels, will, by continuous sympathy, as well as by better regularity of functions, extend to other branches of this wonderful coating. This lining is, to all internal passages, what its analogous and symathising tunic, the skin, is to the external surface, an organ of important senses, and a medium of every communication. The mucous skin, however, is much more sensative, from its tender and villous superficies, and more important in its relations, from spreading, probably, over a superficies, if extended, fifty times that of the outer skin, and lining so many viscera essential to our lives.

No wonder, then, that hectic and constitutional suffering attend on lesions of this sensitive and important covering.

Returning to a particular application of these general remarks, we may mention, that where the violence of opthalmia has been mitigated by proper treatment, and by the admission of soothing vapours, those that are of more astringent qualities are then admissible. As was before stated, the vapour of iodine and water, after a short time, abates sensibility, and, if sufficiently and properly applied, induces a condition of the tunics less suited for a delay of the blood in their veins, or a want of absorbent faculty in their lymphatics.

Though vapour may not be capable of elevating the qualities of the vegetables, yet washing the membranes with their decoctions is preferable to the use of mineral solutions. Dr. Thomson observes, "herbs are now seldom used in the way of fomentation, unless in compliance with ancient custom, or with the prejudices of particular individuals."

If no constitutional fever attend, where the mucus membranes are inflamed, it is often justifiable to persevere in a mode of treatment apparently stimulating, until an altered condition of the part is superinduced. Such practice would be quite inadmissible in diseases of the serous and other tissues. We prescribe the peppers in certain inflammatory complaints of the genito-urinary mucous coats: this practice would be injurious in other inflammations. A consideration of these distinctions would be imperative, if a regular treatise of their general treatment were contemplated. This, however, the subject of *heat* and *fluidity*, on the practical influence of which we treat, cannot embrace. The exposure of inflamed eyes to the vapour of warm water, or vegetable decoctions, is not a novel or untried auxiliary in the process of cure. It has been in use time immemorial, and is recommended in medical works, but in that careless way in which it was formerly applied.* When its use is not continued sufficiently long, to produce the desired effect, the vessels soon resume their increased action, and every repetition of the excitement retards the cure. Poultices, if made heavy, soon oppress the eye by their weight; if light, they quickly harden and dry up, and then irritate and injure. To prevent this, they should be often removed, and mixed with a little fine oil.

When the vessels of the coats of the eye are injected and enlarged, the tunic thickens, and becomes tense; a pressure is thus exerted on the eyeball; this often extends the inflammation. Scarifications, and even discharging the aqueous humours, have been recommended to diminish distension. But the softening influence of warm vapour, acting on the tissues, for several hours, produces a relaxation, and consequent pliancy and relief, which dispose inflamed textures to benefit by judicious medical treatment. When this state of arid thickening, and con-

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* Dr. F. Home, treating of opthalmia, says:—

"Stasis discutitur, .1 Succos acres et salsos corrigendo potionibus diluentibus et demulcentibus. 2. Vaporem aquæ calidae ad oculum, tecto capite, admittendo. 3. Fotu lactis calidi. 4. Superimponendo pulticulam ex candidi panis interiore parte cum lacte cocta, et sæpe renovando."

"Ad maculas et visum imminutum, axungia viperarum oculo crebrius instillata; sal volat. sal ammoniac. oleo majoran. imbutum, et odore crebrius naribus susceptum; vapor decoctionis ex rad. valerian. flor. sambuc. sem. foenicul. oculo admissus; balnea aquæ dulcis; deobstruentia; mercurialia prosunt."

"Beer sanctions the employment of poultices made of bread crumb and warm herbs, or the pulp of a roasted apple. But this experienced author is very particular in qualifying his approbation of moist applications with a caution, that they must never be allowed to become completely cold on the eye, whereby they would do more harm in a quarter of an hour, than any good, which may have been attained in many hours by their previous use."—*Cooper*.

sequent pressure, exist, the pain is much more severe than when the conjunctiva is loose and pliable.

In all passages and canals, or rather on all surfaces of mucous membranes, such as those of the eyelids, mouth, nose, trachea, and in short all cavities lined with this tissue, the suppurative inflammation comes on readier than in serous sacs. For the management of the second stage, where spots of mucous are studding the surface, the decoction of belladonna, nicotiana, and opium, to wash the part, and the long exposure of the eye to tobacco fomentations, are the best general auxiliaries I have experienced. Where pustules, or ulcerated points are observable, the iodine vapour is also very beneficial. Perseverance in the use of some such applications as the above, removes constriction and acrimony, prevents the disagreeable agglutination of the palpebræ, and the irritation and itching of the tarsi. In the intervals of the above fomentations, a little lint moistened in the tepid decoction of opium in oil, placed on the eye, and allowed to filter into it, soothes the membranes and abates irritation. Similar treatment will be found desirable in defending the eye against the exciting effects of the diseased secretions, which sometimes bring on such painful symptoms as to be mistaken for a continuance of the original inflammation itself.

When the violence of the disorder is partly subdued, it is then that colder, more tonic, and even astringent washes, and vapours, are indicated, and exposure to light admissible.

The third stage requires still less soothing treatment than the first. Here the sensibility and over activity are reduced, and a torpid, thickened state of the parts is observed; the lymph becomes more inspissated, and absorption slower. The indications for overcoming this state of things, are chiefly to render the minute vessels permeable, the liquors thin and diluted, and to promote the action of the absorbents. It is here that mercurials, from their influence on coagulable lymph, answer best; and it is here that vapours of more active or exciting qualities are advisable. At the same time, as every useful process may be overdone, so I have noticed the exposure of the eye to the ammoniacal gas, or corrosive washes, to induce a sub-irritative inflammation, which has gone quite too far. We cure one disease, by superinducing another; but we should take care not to expel a milder disorder by one more obstinate, or violent.

The iodine vapour exerts peculiarly valuable properties, in cases of chronic ophthalmia. Though I recommended its inhalation into the lungs in pulmonary complaints, it is then much more diluted. But for the eye, its application is more immediate, and the iodine vapour stronger, the exhalation being raised from a larger quantity of the medicine, in a vase of hot water, directly under the eye. The heat is directed to be kept closer to the organ, than in the first stage of the inflammation. This excites the action of the absorbents, and speedily facilitates the cure. Ten, fifteen, or even thirty grains of iodine, put into a large vessel of boiling water, and set on a table under the face, with a mantle thrown around the head to confine the steam, soon enables a patient to approach much nearer, and to bear it stronger than at first.

A perseverance for several hours, at intervals, during two or three days, with repose, diaphoretics, and the boiled belladonna oil admitted into the eye, in the interim, soon effects a considerable change, and, in general, a perfect cure.

The friends of cold lotions will condemn this practice; but time and experience will enable us to judge between them. Diaphoresis is almost essential in acute diseases of the eyes; but it is difficult to induce or preserve perspiration, if you are pouring on washes, and causing the patient to shiver with frigid lotions of sugar of lead or other salts.

There is certainly a time, when such ablutions may be useful; but it is after the vessels have been emptied by other means, and when it is necessary to contribute to their tone, and to the elasticity of the web on which they are ramified, and when it is desirable to impart to the veins a contractility and resistance to over distension or repletion.

Cold applications, doubtless, afford, in many cases, immediate relief; and nature would suggest their use, particularly, for parts feeling so hot as inflamed surfaces do. But when applied at improper periods, they may fix the condition of lesion, which we wish to remove, and render tedious, or chronic, an inflammation which might be otherwise resolved. It would, however, be as foolish to condemn these applications, in every case, as to recommend warm ones in all; for, not only does the stage of the complaint, but also the season of the year, demonstrate, that a remedy, very admissible at one period, would be highly objectionable at another. A comparatively cold wash may be agreeable, and even salutary, in the heat of summer, which would be very pernicious in the frost.

Certain constitutions and conditions of individuals determine a preference to cooling lotions, in opthalmia.—When they soothe the nerves, allay pain, abate throbbing and excitement, diminish fever, and subdue the four prominent symptoms of the affection, then a reasonable mind will hesitate before relinquishing a plan so manifestly beneficial, and so often congenial to the feelings of the patient,—a criterion which the admirer of nature seldom should despise.* *Beer*, in some cases, recommends cold

* The classic Celsus thus writes:—

"Notæ vero inflammationis sunt *quatuor*, Rubor, et tumor, cum calore et dolore."—*Lib.* 3, *Cap.* 10.

lotions from the first; Richter, Scarpa, Travers, and many others, prefer warm emollient applications, during the acute stage.

Although rheumatic inflammation of the eye is not an affection of the mucous membrane, but rather of the more fibrous tunics under it, yet it may be mentioned, that continued fumigation, from *hot decoctions*, give great relief in that disorder, and aids considerably in producing general relaxation and perspiration.

If, as there is reason to suppose, cold can alter the aggregation, or lessen the fluidity, of the blood, in capillaries, exposed to its influence, and, at the same time, induce torpor of their extremities, we could, in part, account for the larger diameter of such capillaries, the detention of the blood in them, the alteration of colour, and the throbbing and excitement which these chemical and mechanical causes excite in the neighbouring vessels, and in the larger trunks of those that are distended; we could then say with Hunter, that there was "*increased action*," but not where he supposed, and we would be perfectly reconciled to the doctrine of *Vacca*, that the action of the inflamed vessels themselves is diminished. These alterations would, in some degree, explain the causes of the new sensations, superinduced in the nerves of the part,—the distended branches first pressing, and irritating the nerves, and these again re-acting on the vascular organization.

Warm fomentations may relieve and remove the distension of the red vessels, not altogether directly, by acting on them where distended, but on their ramifications, continuous with the parts affected, thus dilating their continuations and rendering them so expansible as to permit the progress of the accumulated blood to advance and pass away, and thus free the stretched vessels from their inordinate fulness in one circumscribed space. Whether this modus operandi of long continued fumigation, and its agency on the surrounding parts, as well as the inflamed, be correct or not, it is certainly more satisfactory, in a practical point of view, than the opinion of Dr. Philips, that the debility of the capillaries is removed by the excitement or increased action of the larger vessels.

It is easy to imagine, that if we can enlarge the diameter or calibre of all the ramifications in advance of the congestion, and, at the same time, thin and dilute the contained fluid by *moisture* and *warmth*, we may rationally expect to give it more permeability, and lessen its quantity, pressure, and stimulus in the inflamed part of the vessels where it was comparatively insulated.

This recommendation of applying long continued heat to *parts far around*, and *outside of that inflamed*, is not acting on any acknowledgment of Cullen's doctrine of spasm of the extreme vessels being a *cause* of inflammation; on the contrary, I look upon any diminution which may occur in their calibre, farther on, along the course of the blood, to be a *consequence* thereof, both from the effects produced on the branches themselves, and their vasa vasorum, as well as on the nerves around them, by the turgidity and altered condition of contiguous portions of the *vessels*.

Whether their diameters be smaller or not than natural, in the parts next to that which is inflamed,—it should be rational practice to dilate them, and let the over load of blood pass on sooner, from a disordered to a sounder structure.

Along with the *general* character here given of opthalmia in the adnata, often extending to the subjacent tunics, there is the inflammation of one or both eyelids. This is often very perplexing, and attended with erosion and glutinous exudation from the palpebræ.

A boy is struck with a book, or a rod, on the eyelid, commonly the upper one, it being more exposed. A red, dense, and tender swelling soon extends from the margin of the lid, back to the edge of the orbit: this is very painful to the touch, and, as it swells, prevents the motion of the part. He cannot suffer it to be touched or examined, insists he feels some gritty or sharp substance under the lid, towards the back of the eye. In this case there is no intolerance of light, as the eyeball seldom becomes affected; but there is a remarkable degree of dryness, in fact a total absence of secretion, and the puncta lachrymalia appear parched and closed up. Of course there is no moisture of tears along the lachrymal duct, and the nostril of that side consequently feels hard and dry. This occasions sneezing, which adds greatly to the pain, and produces an appearance, at every shake of the head, as if lightning were flashing across the sight. There is commonly, at this time, quick pulse, thirst, dry tongue, and more anxiety than when the eye itself is inflamed.

For this affection, much the same auxiliary treatment is indicated, as was spoken of, page 198. After the long continued fumigation, when the vessels are softened, it is advantageous to keep an eye-cup, or a spoon, to the under part of the eye, full of the tepid decoction of digitalis in oil. By endeavouring to open and shut the eye, the liquid is, as it were, pumped from the spoon by the edges of the tarsi, so as to be brought in contact with the lining of the lids; this lubricates the meibomian glands, and palpebral conjunctiva, abates the feeling of dryness, and removes the sensation of extraneous substances in the eye. By continuous sympathy and actual contact, it relieves any irritation which might have extended to the conjunctiva of the eyeball, soothes pain, and gives the patient that feeling of comfort and confidence, which in itself contributes to the cure.

Some practitioners object to any oily applications to inflamed surfaces; but the eye and the ear will almost invariably experience relief from being moistened and bedewed with warm emollient lubrications.

If the third stage set in, and suppuration come on, a pledget of lint kept constantly applied with the above oil, and the exposure to rather warmer and more active fumigations, sooner induce the desired crisis. For if cold applications be now *constantly* used, a chronic case is produced, likely to be long troublesome and perplexing.

The further consideration and additional modes of managing these matters come under the department of the surgeon.

I must candidly confess, I have not been able to bring the fumigation to my assistance, in a sufficient number of cases of erysipelatous inflammation of the eyelids, to speak with confidence of its aid. It may be observed, that where the secretions from the lachrymal and meibomian glands, and from the mucous surfaces, are so much increased, and where exudation of lymph follows, with subsequent desquamation of the external cuticle of the lids, it would probably answer a better purpose, under such circumstances, to direct a current of dry air, moderately warmed, into the room. This suggestion is the more plausible, when we consider the injurious impressions made by damp cold air, or by cold fluids. Beer recommends exposure to mild dry air. I certainly think, that in winter and wet weather, it would be desirable to warm and dry the air by art.

Purulentæ.

THAT description of suppurative inflammation of the palpebral conjunctiva, which sometimes ulcerates the corresponding coat of the eye itself, differs in no specific character from similar diseases on other mucous surfaces, such as those of the bronchiæ, or urinary lacunæ. The application of the soap, (mentioned page 22,) answers admirably as a topical application to these purulent patches.

The circle of discharging glands, which sometimes range along the ciliæ, studding their margins with red, itchy, granular, inflamed swellings, discharging matter, and inducing epiphora, or a superabundant secretion of tears, is speedily relieved by penciling the *tarsi* with the levigated ointment, (mentioned page 7,) at night, and the iodine ointment, alternated with the linament, described page 21, during the day. These local remedies obtund the acrimony of the tears, and hinder the excoriation of the cheeks. In this and the other stages of purulent opthalmia, the most marked attention is requisite, to regulate the proper state of the skin and bowels. In cases of purulent palpebræ and swellings of the meibomian glands, particularly in scrofulous dispositions, pungent iodine fomentation exerts great influence, when the more acute stage of the inflammation has subsided.

Whether certain kinds of inveterate ulcerative opthalmia be contagious, or derived from exposure to the predisposing causes, such as noxious miasmata and animal effluvia, uncleanliness, foul, damp, or night air; whatever be the cause, the prevention might often be attempted by covering the coats of the eyes with bland oil. This might, certainly, in many cases, hinder the accession of the complaint, particularly if persons be exposed to the contact of matter, or virus, likely to produce the disorder. For, as was mentioned on a former occasion, oil has some effect in resisting the lodgment or settling of virus on surfaces, repelling the poison like a varnish. It is probable, that washing the eyes of an infant, immediately after birth, and then applying oil, might sometimes prevent distressing purulent opthalmia, where there is reason to fear that contagious, or even acrid fluid would have entered the eyes in transitu.

Though it may seem a little out of place, yet it may not be deemed out of season to diffuse more widely the following narrative of the efficacy of oil, which, *if it can be credited*, is rendered more interesting, at this moment, from the death of our much respected friend, Mr. Hervey.*

The following account is taken from a letter to the authors of the *Journal de Paris*, May 31, 1785:—

"He told me, that while he was in a town in Persia, a mad-dog went into a workship where several men were employed in making oil; he instantly bit the leg of one of the workmen in three places. The man, endeavouring to avoid the animal, stepped into a large vessel of oil that stood behind him. One of his companions hastened to his assistance, and encountered the dog with a stick; but before he got the better of him, was unfortunately bit in the leg likewise. This man did not happen to step into the oil, as the one did who was first bit, and he shortly after died of hydrophobia; whereas, the man whose wounds were moistened with the oil, never showed the least symptom of it. The dog that was killed had bit several other dogs, which, in a few days, were seized with madness, and communicated it to several of the inhabitants. One of the strolling physicians, with whom that country abounds, was in the place at the time;—he made a proper use of the fate of the two workmen. He dressed all the wounds given by mad dogs with oil, changed the poultices frequently, and even made the patients take a little oil inwardly. Not one of his patients died, and all those who were not treated in the same manner perished miserably."—(For similar accounts see Goldsmith's *Animated Nature.*)

Of that species of continuous inflammation of the mucous membranes of the eyes, nose, and bronchiæ, which is sometimes epidemic, I shall speak, when I come to

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* This lamented Gentleman died of hydrophobia in 1829.

say a few words of a similar affection in measles, where the treatment, so far as regards inhalation or fumigation, is nearly the same.

Many other varieties and modifications of inflamed and ulcerated mucus surfaces of the eyes, or palpebræ, we must pass over, referring their treatment to the judicious practitioner, who will appreciate how far the plans of soothing fomentations in the one kind, or state, and of active, and even stimulating fumigations in the other, are deserving of further trials as subsidiary agents of cure.

Case I. Mrs. M'Gahan, Edward-street, having attended her sick child some nights, owing to want of rest, felt the eyes stiff, warm, and unable to endure the light, with overflowing of hot tears.* On applying to me, I found the conjunctiva covered with red vessels, and the tarsi thickened and red. There was no constitutional disorder. A saline aperient prescribed, with three or four hours' fomentation over five grains of iodine in a basin of hot water, set on a table. Over this the face and open eyes were retained, and the head covered close. Profuse perspiration came on, and the patient repeated this simple process three times next day, when she was well. The opium oil afterwards kept the tunics in good disposition.

Case II. Mr. Malally, Distillery, having been often exposed to sudden heats and colds, became subject to severe attacks of rheumatism; afterwards his eyes became inflamed. Having lost time in applying lotions, and in other useless proceedings for the first stage, a chronic thickening of the conjunctiva took place, and white skinny plates formed several spots. Ten grains of iodine were thrown into a pot of boiling water, which was placed on a chair, whilst he sat on another, holding the

* Taraxis of P. Egina.

eyes open over it. This he continued some hours daily. The improvement was rapid, perfect recovery succeeded, in five or six days, and the organic specks were speedily absorbed: on one occasion he was bled, owing to pain of the head having returned. Little or no medicine was employed.

Case III. Mr. ——— a solicitor of Dublin, having been exposed to cold, contracted an inflammation in one eye, which was particularly violent and sudden. On arriving at the hotel, he complained of acute pain darting to the bottom of the eye, severe head-ach, the tears burning hot, thirst, skin warm, pulse quick,—the conjunctiva is pushed out by some infusion of extravasated blood under it, which lifts it up on the eyeball, and forms a puffy swelling, covering the cornea, and appearing like a piece of boiled lung. This forms a gap, *(chemosis,)* through which the middle of the eye is just visible.

This gentleman being young and healthy, was instantly bled, ad deliquium, and the eye washed with milk and water. In the evening, the throbbing and pain continuing, twelve leeches were applied to the temple. This part, and the eye, were kept over a basin of warm water, and washed for some hours, promoting the bleeding, until the severity of the head-ach subsided. Large draughts of cream-of-tartar solution were given warm, with a few drops antimonial wine in each drink. At bed-time, pledgets of lint, soaked in tepid opium oil, were laid on the eyes.

Next morning, the constitutional excitement being nearly gone, ten grains of iodine were mixed in a basin of hot water; this was settled down at the end of the pillow, the head and vapour covered with the blanket. The steam was admitted to the eye, which at first occasioned some uneasiness; but the object being to excite the absorption of the effused blood, the pain was not severe, nor an obstacle to the practice. The fomentation was continued four hours, — profuse perspiration followed, pain entirely gone. Next day the iodine vapour was very conveniently applied, in the drawing-room, from a smelling-bottle, containing a drachm of iodine and two of alcohol. This *toilette medicine*, "which ever and anon he gave his" eye, when held near it in the warm hand, diffused abundance of pungent vapour into the organ, which rapidly promoted the absorption of the effused fluid. This gentleman was perfectly cured in three days from the first attack.

Numerous other cases might be adduced, demonstrating the value of iodine in removing pain and inflammation of the eyes, and communicating tone and consistence to the tunics.

Though not altogether within the limits of our subject, yet, if useful to poor workmen, we may be excused for observing, that persons who make mortar or slake lime, should have a little vinegar and water convenient, instantly to wash out any spark which may enter the eye. This might often prevent the specks on the cornea, and even blindness, to which builders and their assistants are frequently liable.

Reversing the chemical principle of the wash, an alkaline solution of a little soda or pearl-ash, would at once neutralize any drop of mineral acid in the eyes, to which accident bleachers and laboratory-men are sometimes exposed.

This subject has extended far beyond my intended limits; but when we are aware that Doctor Plenck's methodical arrangement of the inflammatory diseases of the eye, and its other ailments, presents no less than one hundred and nineteen genera, comprising about six hundred species, my prolixity will not be surprising.

Ottitis.

INFLAMMATION OF THE EAR.

A PERSON sits, bareheaded, near a window; a current of cold air enters the ear; the wax becomes hard at night; on endeavouring to pick it out, it is found dry; beating pain supervenes, with heat. If the ear be leaned over a vase of warm water, for some hours, the mucous membrane begins to discharge moisture, the sebaceous glands become humid, and secrete cerumen, and the collected wax, which is so shamefully allowed often to accumulate, and obstruct the meatus or external auditory passage, is softened, and more easily detached, with proper persevering syringing.* In a day or two after, the activity of the inflammation subsides; the introduction of warm oil soothes and relaxes, and in a short time the patient is well.

Eliza Rennie, Ballymacarrett, being exposed to cold and wet, contracted severe inflammation of the lining tissue of the left ear. As it is requisite sometimes to give an appearance of importance to a simple remedy like the vapour of water, to be effectually used, she was ordered to boil a few grains of opium in a quart of water. This was put into a jug, and covered with a cushion of cloth, folded up so as to leave a space in the centre, through which the vapour ascended to the ear, when resting on the cloth. Three or four hours' perseverance removed the excessive acute pain, and, as the head was covered with a cloak, produced copious perspiration, which prevented any constitutional derangement.

If the disease had been neglected, till fever, lancinating pain, redness of face, and head-ach commenced, then

* E numero eorum quæ meatum obstruunt, sordes esse quæ in auribus colligi solent.—HIP.

leeching and general treatment would have been requisite; and, after all, suppuration, and probable loss of hearing might have been the consequence.

Coryza;

OR, INFLAMMATION OF THE NOSTRILS.

AFTER spending an evening in a warm apartment, and drinking hot liquors, a man, returning home, exposes himself to rain and cold. He soon inclines to sit near the fire; feels a slight shivering, and coldness between his shoulders. Next morning he experiences some obstruction to the free passage of the breath through the nose; he complains of dull, heavy compression in the forehead, over the frontal sinuses.

The lining of the nostrils is dry, hard, and disagreeable, with frequent sneezing and loss of smell. When the patient looks at you, his eyes fill with tears; and, though he suffers little acute pain, his aspect is much more lugubrious than when he was last night quaffing his exhilerating libations.

"Suspiciens patulis captavit naribus auras."

If the case be neglected or mismanaged, till the second stage, copious, acrid, and excoriating secretions come to be discharged, sometimes yellow, green, or reddish brown. In a later or third stage, purulent fœtid matter is poured out, and is extremely unpleasant to the patient.

When infants are allowed to remain long undressed, or exposed to a cold current of air, this complaint is apt to come on. It is to them very distressing, as they are compelled to breathe by the mouth, and cannot then suck without interruption and difficulty.

TREATMENT.

From what was said of the assistance derivable from fomentations in opthalmia and ottitis, it will be anticipated, that so much of the remedial measures as come within the scope of our outlines, will be a recommendation of the same application. As in this case there is a general complaint of the whole system, or what is well termed *a cold*, with, sometimes, a sharp cough, from continous irritation of the mucous coats extending along the bronchiæ; to counteract these, the warm or tepid bath will be found particularly beneficial, and it should not be used so hot as to hurry the pulse or breathing. With respect to fumigations, they are very important here, as they apply directly to all the folds and windings of the *schneiderian membrane*, or lining tunic of the nasal passages. Here, in the first or dry state of the membranes, copious *inhalation* of the vapour of boiling water, with or without that arising from demulcent herbs, is indicated. It should be drawn in both by the mouth and nose ; held over a large vessel for several hours, keeping the head covered, and encouraging perspiration by copious, warm, diluting drink.

In the second or pituitary stage, when the icy, cold, *albuminous* liquid distills from the nostrils, the fomentations should be warmer, and raised from some more pungent herbs. The inhalation from the decoction of tobacco, answers well. In the third or purulent state of the disorder, active exciting vapours are required, conveying some medicinal principle, calculated to induce a new action in the parts, promote the expulsion of the matter, dilute and blunt its corroding properties, clear the surfaces, and, in cases of ulcerations, to accelerate the growth of healthy granulations.

Here, also, the addition of some pleasant aromatic to the decoction, diffuses an odour, now very necessary, to obviate the smell of the purulent discharges.

Apthae, or Thrush.

THESE crusts are exfoliations of the epidermis of the membranes of the mouth, fauces, tongue, and other parts, produced or pushed up by vesicles on the outer surface of the subcuticular mucous membrane. Nothing more strongly demonstrates the sympathy of the skin, and its elongations and transitions into the mucous canals, than the circumstances, that in cases of thrush, particularly the chronic kind, there is an extreme degree of dryness of the entire external surface. In the early or inflammatory stage, when whitish or ash-coloured vesicles appear, and before the epidermis is elevated in little scales, a few warm baths, with diaphoretics and aperients, will tend to remove the exciting causes in almost every case. At the same time, if the patient be of an age to take advantage of exposing the surface of the mouth and throat to the softening influence of warm fomentations, the albuminous fluids which raise the small eminences, will be enabled to escape, in many instances, without producing the desquamating patches of cuticle at all.

When this step has been neglected, and the apthous crusts are hard, with tender margins, long continued application of vapour softens, and brings them to a condition of being easily removed by deterging applications.

The continuous sympathy of the alimentary canal, six times longer than the individual, is truly surprising. Acrid or acid contents, or even worms in any part of the intestines, will occasion apthæ on the tongue and fauces. On the contrary, exposure to damp and cold, closing the pores of the skin, or even feeding a child with food too hot, and inducing irritation in the mouth or gullet, will occasion an excitement, extending along the entre mucous lining of the bowels from one end to the other, which, if neglected, will spot their lacunæ and folds with apthous scales, to the extreme termination of the primæ viæ. This points out the propriety of washing out the passages, removing irritants, and adopting a plan, shamefully neglected in bad cases where the larger intestinal lining is affected, of filling them with bland, warm enemas, which dilute and wash away the sour secretions, sheath the tender villi, and act for the time as valuable fomentations.

In that severe sympathetic thrush, affecting persons of bad habits, in climates liable to great viscissitudes of temperature, where there is an arid state of the skin, with chillings of the limbs, the means above referred to, will considerably assist the general curative indications which each particular modification of the disorder may demand.

This is sometimes a disease, or rather *sympathetic condition*, of considerable importance, when it extends over the larynx or trachea; or when it spreads along the digestive tube, constituting osophagitis, or gastere-enteritis. This consideration might entitle it to some more limited definition, in an order more appropriate to the diseases of the mucous surfaces, and as analogous scaly desquamations may be entitled *squamosæ*, among the *cutaneæ*, so these epidermal plates may, for the sake of appropriation to a certain tissue, be defined, lamellosæ, as an order, or rather genus, of the class *mucosæ*.

The membrane covering the velum pendulum palati, uvula, and back part of the throat, is subject to a kind of soft vascularity, and injected state, presenting the appearance of being studded with points of blood, which, particularly on the apex of the uvula, seem loose, as if extravasated. There is a continued burning sensation, not acutely painful, but keeping the patient in constant anxiety. This feeling is augmented in damp weather; and, as it occurs, for the most part, to dyspeptic persons, adds another ailment to their long catalogue of woes.

I found this relaxation of parts so irksome and unmanageable, that I published some account of it in the Edinburgh Medical and Surgical Journal, in the hope that some speedy method of cure would be pointed out. As might be expected, an altered state of the alimentary canal, and even of the skin, almost instantly varied the condition and pulpy appearance of this tissue.

In two or three instances it entirely disappeared, when the stomach was restored to health: it showed its most aggravated form in persons who had been martyrs to long continued courses of mercury. In the treatment, constitutional means are chiefly to be kept in view, and particularly such as promote digestion, and remove constipation. Gargles were never found of use: sometimes port wine was beneficial, particularly when four or five generous glasses were let down after the topical ablution.

The state of the mind has particular influence on the complaint: in fact, it was seldom observed, except in those who are more truly than philosophically designated by the term "melancholic temperament."

The little dots of pendant blood, which seem as if almost oozing from the surface of the membranes, and only detained by their epidermis, bears so much analogy to *passive* sanguineous discharges from the bronchiæ, linings of the bowels, and other viscera, that such affections might, probably, (with a view to practice,) be designated along with the sub-divisions already hinted at, under such a denomination as "SANGUINOSÆ."—Some such methodical arrangement, under the great class of mucous complaints, would be more than a mere parade of terms, and might serve as a specific distinction from *active* hemorrhagies of other characters.*

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* See page 34, of this Treatise.

Before diverging with either of the two great divisions of the mucous canal, either to lungs or stomach, we may say a few words respecting the funnel leading to these passages, called fauces, or superior cavity, or commencement of the throat.* In this paper, which does not profess to treat, either anatomically or medically, of the distinct disorders, or entire treatment of parts, it would be affectation to confine the consideration of the general media of *heat* and *moisture*, here spoken of, exclusively to the mucous membranes, where the fibres under them, and the glands around, partake so generally and reciprocally, in the inflammatory action, communicating so fast from one part of this loose and vascular texture to another.

Hence, what is now to be said will refer, generally, to those affections called quinsey, including swellings of the tonsils, as well as to the deeper and more sudden inflammation of the mucous membrane lining the funnel of the larynx, or top of the windpipe.

A young lady changes her dress, some damp evening in October, and, in light attire, proceeds to a splendid assembly. After the exercise of dancing, and also exciting the sensibility of the trachea, by singing the ominous "*Stilly night*," and the "*Bare neck of snow*," returning home at dawn, she sensibly feels the difference of temperature between the frosty air of her carriage, and the atmosphere of a heated drawing-room. She soon discovers a slight pain and difficulty in swallowing, and, as if things painful were to be repeated, she is constantly teazed renewing trials of deglutition, which give her such uneasiness.

In a few hours after, the ears are painful, with sneezing, and soreness of the eyes; the head is thrown forward in attempting to swallow, and the chest raised up as if to meet the effort. The tones of voice, lately so melo-

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* Ισθμός.—Hɪᴘ.

dious, are now hoarse and suppressed. In a short time come on deafness, throbbing under the ears, dryness of the throat, with frequent endeavours to disentangle a little tough, glairy mucus, which feels icy cold, though the fauces are burning hot. As the complaint advances, breathing becomes laboured, and deglutition difficult. This is now the more irksome, as thirst is urgent. If the tonsils continue to swell, the membranes covering them are put upon the stretch, and a feeling of distension, at the corners of the velum of the palate, gives great distress. Speaking is avoided: the few answers to questions are uttered as if the words were divided in the passage. Cough sometimes aggravates the sufferings, by increasing the pain of head, and shaking the inflamed neck.

If nothing be properly done to relieve the patient, or arrest the progress of the inflammation, the tonsils approach each other, the uvula and tongue swell, the pulse becomes hard, full, and quick, and the carrotids throb and pulsate violently. If, at this time, the afflicted lady be attended by some timid, imbecile practitioner, and her neck be again exposed to cold, during the tedious or ill managed application of four or five leeches, and endeavouring to wash her throat with cold gargles, TIME, the most valued consideration of the *able* and *decided*, is lost;—the eyes start forward—the cheeks change the rose for the purple tint of congestion—the wretched gargles are returned from the nose—she is forced to sit erect—gasps wildly around—delirium supervenes—suffocation is impending—the face rapidly becomes cold, and sunk, and livid—the pulse subsides and intermits—one tremendous effort is made to inspire air—a convulsive thrill succeeds—and the angelic hope of her friends and her family is no more.

The auxiliary agents, of which we have been treating in the foregoing papers, might have been useful for *prevention*, but could little avail in the hurried hour of danger. On the first accession of the disorder, a warm bath and fomentations, with copious warm diluents, so as to induce perspiration, might have mitigated the rapidity of the tumefaction, and prevented the catastrophe so generally lamented.*

When the tonsils swell, it is necessary to divide the membranes over them, to take off the tension, and empty the vessels. Another advantage succeeds this practice,—that even if matter form among the subjacent cellular fibres, or in the glands themselves, the *free incisions* give it a facility for pointing and discharging, when the pressure of the tunic is taken off. Whereas, if it be undivided, it is here so elastic and extensible, that the suppuration may push it forward on each side, until it close up the throat and choak the patient. Sometimes the great collection of matter will burst, and suffocate, when neglected.

Where these membranes, and even the enlarged glands themselves, are freely sliced and laid open, there is not such probability of their becoming studded with apthous crusts, or troublesome and malignant exulcerations, as when its texture is altered by being tense. If this precaution have been early and sufficiently attended to, the inflammation cannot proceed to the extent and violence of suffocating the patient, and a much more formidable operation, that of *making an opening into the trachea*, may be avoided. Many instances of the necessity of this proceeding and its success, are on record. See Ballonius, Fienus, Musgrave Phil. Trans. 11, 258. Louis, Bell, Burns, &c.

As was hinted before, (page 25,) the contact of air is prejudicial to these incisions, when we divide the thick-

* An affecting case is just now recorded in the papers; that of a young lady who was suffocated by sudden suppuration in the throat, the day on which she was to have been married.

ened coats covering the tonsils. During the first stage, there is a dryness of the throat and suppression of healthy mucus, and other secretions. When the membranes are cut, the swelled parts under them make the sides recede, and the wounds gape. If these incisions be exposed to a current of air, or festered with acrid or irritating gargles, then blackness, and sometimes sloughing, will be the result. At this moment the inhalation of simple, or perhaps medicated vapour, is a beneficial auxiliary, resolving the surrounding inflammation, softening the tissues, diluting and loosening the ropy phlegm, contributing to the expansibility of the fibres of the tunics, defending the incisions from the dry and cold air, bedewing them with tepid moisture, and all the time facilitating that most desirable remedial measure, at the beginning of such febrile ailments, a free and copious perspiration.

To induce sufficient diaphoresis, where the patient cannot swallow medicine, is sometimes very difficult; but a long continued confinement of the head, neck, and breast, over a large pot or vase of hot water, and covering all with a blanket, will soon abundantly open the pores, whilst at the same time it will very much assist in resolving the inflammation, and, if long continued, of inducing that relaxation and temporary debility, so necessary to arrest the untoward progress of such diseases.

Even in cases were patients are able to swallow, half the quantity of diaphoretic medicines will suffice, if we enjoin a few hours' determined fomentation from a whole current of vapour, received under the bed-clothes in the breath.

Doctor Thomas, who, with most other writers on these subjects, recommends inhaling warm vapour, states, that "where Mudge's inhalers cannot be procured for the purpose, we must be content to substitute a basin with an inverted funnel over it."

Now, as I strongly object to the old plan of half measures, so I dislike all those inhalers and funnels which direct only a small stream of vapour to one point, and leave the rest exposed to the action of the exterior air. In fact they do more harm than good, by their irregular action and insulated operation. The vapour would give benefit from the whole surface of the basin itself, but not so from a small point through the tube of a funnel. As was stated, under opthalmia, warm vapour does most good by expanding, relaxing, and pervading the tissues and ramifications around, and in advance, of the inflamed part itself; so that I calculate on deriving more benefit from the long continued agency of vapour on the *sound parts,* than on the diseased, however advantageous it is even to them. But, to do the work right, several hours at a time must be spent over it, until the excited parts are fatigued and soothed, and the others softened, and permeable to free percolation.

In the second stage, when viscid albuminous mucus is filling the fauces, the arteries throbbing and the face red, then copious abstraction of blood from a large orifice will be essential. Leeches, as commonly applied, are dilatory, and expose the parts too long to cold air. But if the patient sit in a warm bath, twenty leeches fixed at once, will answer well in robust cases, where the symptoms threaten to be violent. After the leeches are removed, the patient should keep the parts over the steam of warm water, to promote the discharge of blood, and prevent *cold* damp sponges or clothes being applied.

There are circumstances and cases, where the third or *suppurative* stage is the safest termination. This is more obvious in persons subject to formations of matter in the tonsils. Patients, also, of delicate systems, or bad habits, have reason to fear sphacelated membranous decomposition, with constitutional typhus fever, if the third stage be interrupted. Here again warm fumigation encourages the process of forming pus; for, as was said before of atomic changes, if the fomentations do not resolve the swelling, they aid its formation of matter; if they cannot dispose the parts to terminate the first or second stages favourably, they conduce to promote the proper condition for completing the third.

There is also an advantage in this plan, calculated to strengthen confidence in the attendant. The friends of the patient will not be so ready to insinuate, or to say, that the surgeon was deceived, and that the suppuration is "*come forward*," which he was endeavouring "*to put back*."

If, as occurred to her, who never can behold her parents more, "nor friends, nor sacred home,"—if, as is too often the case, the trifler in attendance postpone demanding the aid of some active and decided practitioner, and you arrive when the gasping patient is almost expiring, and the countenance of dissolution coming on, and the hurried attendants standing aghast,—then,—instant,—strike the boldest blow for life,—with your penknife, or scalpel, or scissors,—with any thing,—open up an orifice in the trachea,—keep that aperture dilated,—fill her expanding lungs with the breath of life once more, and give back to her adoring circle, the child,—the friend,—the lover.

If, arriving later still,—and the silence of sorrow, and horror of the spectators, have given way to the long, loud expression of despair,—and if the pure and perfect soul seem already to have fled to more kindred associations,—still, yet, even then,—late,—and, alas! too hopeless,—penetrate that pipe, which, but three nights before, drew from the fairy scenes around, the listening and admiring gay and glad array, hanging with breathless silence on the soul-subduing sounds,—still, yet, immediate, pierce the passage for the atmosphere, and with a pen, tube, bellows, pencil-case, or any pipe, blow air, and elevate the chest,—and in the moment of dismay, and in the hour of horror, again expand the organs of respiration,—persevere, and linger on the last sad indulgence of a hope, that a single spark may yet remain to be revived.

Remember the motto of the Humane Society: "*Scintilla Lateat Forsan.*"

Laryngitis.

INFLAMMATION OF THE LARYNX.

The inflammation occupying the superior portion of the windpipe, is even more fatal than that of the isthmus itself. It is also more sudden, destroying by suffocation in a day or two. Brassavoli, and Schenk, relate cases which killed in a few hours.

In this disease the epiglottis is tumid, the fauces red and turgid, and, during the first stage, hard and dry, with difficult deglutition, high fever, and painful constriction of the throat. The voice soon becomes acute, then brazen, and, lastly, stridulous. The second stage coming on, endeavours are constantly making to expel the cold viscid mucus. The aspect is most anxious, mouth half open, respiration quick and difficult, spasms of the muscles of the neck, and distressing panting for air, until the patient is relieved, or death shall terminate the terrible disorder.

Here the treatment above referred to is to be even more actively employed; and, if necessary, the same operation resorted to, to save or prolong the wretched patient's life.

In cases of laryngitis, Dr. Good recommends "gargles of *ice-water*, acidulated, and epithems of *pounded ice* applied *externally*, in preference to blisters and relaxant inhalations." Dr. Home prescribes the vapour of warm water and vinegar, but, as usual, to be received through the tube of a funnel.

"Vapore calidæ aquæ cum pauxillo aceti faucibus per infundibulum applicatæ."*

I fear the fate of the patient will be little averted by either of these applications.

Bronchitis.—Croup.

THIS melancholy and most formidable of the species of MUCOSÆ, nips many beautiful and early buds, and is truly an opprobrium of the art of medicine.

An affectionate mother commits her little charge to the nurse, she repairs to a window, which she opens, the better to be seen, and the child, in the meantime, is exposed to a current of cold air. *Teething*, it has salivated and wet its dress about the neck and chest. The nurse, regardless of its comfort, adjusts her own ornaments, and when the infant, chilled by cold, is overcome with sleep, it is laid, frigid and wet, in its narrow cradle, and shall soon recline in its narrower tomb.

In the morning the nurse observes the child dull, flaccid and pale: these observations she carefully conceals; and it is not until the mother is startled by a cough of peculiar shrill sound, that her attention is arrested. On closer examination, she finds there is hoarseness, with hard, dry, cough. The breathing soon becomes frequent, and a whizzing sound is obscurely heard in the throat, as if the air were passing among glutinous globules in the passage; the cough becomes more and more shrill and sharp, restlessness and dyspnæa supervene, with hissing breathing, and the crowing cough begins to bring up some tough filamentous phlegm.

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* Dr. Home's Principia, p. 118.

When the spasms become more constricted at the glottis, or chink of the windpipe, the little patient raises his feeble hand towards the neck, tosses the head, now to one side, then to the other, there is an appearance as if strangulation were threatening, the face is swelled and congested. As the disease advances, the difficulty of breathing increases with wheezing, the fits become more frequent, with sonorous inspirations, the countenance soon assumes a livid hue, the eyes are protruded, and look wistfully around for relief; the lips are blue, extremities soft and cold, and friendly death at last relieves the little sufferer from misery, which it must be very tenacious of life to have endured so long.

The treatment of this disease is difficult. Decided, bold, and speedy measures are essential: trifling will not do.

In this fatal complaint there is debility, at the same time that there is active inflammation, notwithstanding which weakness, bleeding and warm bathing are essential. Indeed, without these, particularly the former, there is not a condition calculated to profit by medicine. The most effectual bleeding is by a row of leeches along the middle of the trachea, and one at each side: the best mode to cause them to fasten directly along the part, is to make a slight longitudinal incision in the scarf-skin, where it is desirable to fix them. If the leeches scatter about the neck, they are of little use: during the time they are on, and after they fall off, the child's face and neck should be retained above a current of tepid vapour. In this case, inhalation will go on as a matter of course with the breath, and would be still more effectual, if we knew of any fumigation capable of preventing the consolidation of the false membrane in the windpipe, or arresting the alteration of the fluid secretions. It is probably by the influence of mercurials on fibrine, as mentioned before in this treatise, that the large doses recommended by Doctor Hamilton can sometimes effect a cure.

It unfortunately happens, that this medicine has not sufficient time to exert its beneficial powers on the disease: there is such high and rapid action going on in the constitution, that the mercurial effects cannot proceed.

If we could produce a condition of the system calculated to subject it immediately to the salivating power of mercury, we might certainly expect to hinder the conversion of the albuminous and lymphatic liquids in the trachea, first to gluten, and then into fibrine. The great desideratum in the exhibition of this remedy, would be to obtain at once its *secondary* or *asthenic* influence, without its *primary* or *febrile excitement.* But it unfortunately occurs, that before the solvent effects of mercury are available, the malady runs through its stages, and death too often comes, before the curative quality of the remedy begins to act.

Is there any mode of elevating the mercurial preparations in vapours combined with iodine, or any mineral or vegetable fumigation, which could be inhaled at every inspiration, and imbibed by the skin,—can the system be thus speedily impregnated, and a soluble condition of the atoms induced?

The considerable spasmodic irritation of the parts, might probably profit from the vapour of nicotiana in decoctions. These are investigations adapted for some humane medical societies, who might be disposed to turn their joint attention to the spirit of these anxious inquiries.

1. How far will the use of the warm bath and inhalation of aqueous vapours tend to dispose the system of a child, or an adult,* to the reduction of inflammatory action in cases of croup?

* Dr. Cullen confines croup to persons under 12 years.

2. What is the safest gas that can be inspired, and which might be expected to keep the exudation of albuminous mucus, and lymph, liquid and uncoagulated in the windpipe, or prevent the organization of adventitious membranes in the passage? It is said that soda retains the albumen fluid in the blood. Has ammonia this property when duly diluted with water?

3. How much sooner will the same quantity of mercury induce salivation, and reduce the system to a non-azotized state, with continued fomentations and warm bathing, than without them?*

4. Is there any change of proximate principles, or ultimate elements, capable of altering the condition of mucous membranes, or causing them to assume the faculty of secreting serous lymph; or, is not the sero-albuminous matter poured into the trachea in croup,—partly transfused from the subjacent *fibrous* tissues, and partly from the mucous tunic of the diseased tube. Is it thus that the false membranes form inside the intestines, from compound animal fluids easily convertible into fibrine?

5. If, as was so often remarked, there be untoward atomic changes, either in the fine texture of the coats

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* "The advantages derived from the vapour bath, in restoring the strength of persons debilitated by the use of mercury, induced me to employ that remedy more frequently during its exhibition, in the hope of preventing those evils it had only been hitherto applied to remove. In pursuing this indication, I could not but be struck by the greater facility with which the mercury acted upon the constitution, the comparative rapidity of the cure, as well as the diminution of the poisonous effects of the mineral, when the bathing was employed in conjunction with it: I have, in consequence, generally adopted, and after an ample experience in the Naval Hospital, and private practice, for three years (since the establishment of baths in Dublin,) I can assert, that in every instance where I combined these two remedies, the patients recovered in nearly half the time, and with little more than one-half the mercury usually employed in such cases."—*Sir A. Clarke, p.* 70.

themselves, or in the liquors they secrete, is it warrantable to induce, at once, some different action, in order that a mutation of excitement may superinduce a change of disorder?

6. Is there any prompt application, or inhalation, which could induce a speedy suppurative inflammation, in place of an adhesive one, that could cause *pus* to be thrown out along the tube, instead of what is called coagulable lymph?

7. As the application of a certain diseased discharge, from a mucous surface, will induce purulent opthalmia, is there any possible method of promoting a secretion of matter, which would run off loose, and detach the adventitious membranes, or altogether prevent their consolidation in the trachea?

8. Does the hot cubebs pepper, given during an inflammatory state of a certain mucous canal, remove the diseased excitement, by superinducing a new and altered state of the tunic; or a different species of secretion, such as sero-purulent, in place of albuminous? The analogy of the comparative processes and modes of treatment, in the horse and other animals, has not been sufficiently observed in diseases of the mucus surfaces of the windpipe.

9. It having been long observed, that sneezing aids in producing a discharge from the nose, and preventing suffocation in diseases of the throat, would the strong fumes of acrid vegetables, such as tobacco, white hellebore powder, or euphorbium, or the use of active mineral sternatatories, be justifiable, as conducing to bring on a new action in the pituitary membranes of the nose and fauces, which, by vigorous and energetic perseverance, might be continued down to the trachea, as catarrhal affections extend along the same surfaces, and thus induce an altered secretion to take place? In short, can we bring on

the third, or SUPPURATIVE degree of disorder in the trachea, and hinder the progress of the second, or ALBUMINOUS inflammation. And if we can produce this change on the mucous membrane of the fauces, is it probable that continuous purulen tevolutions of matter will extend along the throat.

13. A feather, smeared with a mixture of one part sulphuric acid, and two of oil, plunged into the throat, will bring up ropes of mucus, in bad cases of quinsey, and enlargements of the tonsils, and will give instant relief, even where the eyes are protruded, and the patient threatened with strangulation. This I have repeatedly experienced in practice. Of course, this is not directly applicable in croup; but some modification of it might be indirectly beneficial.

11. It is only when plentiful discharges of puriform matter are forced out on the surface of the villous tunic of the intestines, that the adventitious membranes of coagulable lymph are thrown off. When these were carried away in cases of dysentery, I have seen the new made tubes so perfect, and so similar to the intestines which they lined, that great persuasion and reasoning were required to convince the patient that the expelled canals were not portions of the bowels, but a new pipe formed inside of them, by an undue formation or deposition, and apparent organization of fibrine, or what John Hunter would call the result of *healthy* inflammation.

12. Fibrine will form apparent polypi, in the cavities of the heart, after death. The structure of these is sometimes so firm and fleshy, as to have been groundlessly accounted the cause of dissolution.

If we cannot prevent the coagulation of fibrine, by producing pus, can we change a disorder like croup into one bearing some analogy, such as catarrh or influenza?

The vaccine matter renders the substance of the true skin incapable of engendering or perfecting the small pox. The measles, also, affecting a person a sufficient time before the inoculation for small pox, arrests the progress of the pock in the wound, and delays it till the fever of the measles have finished its career.

12. In catarrh there is a certain extent of inflammation of the mucous membranes of the nose, fauces, trachea, and bronchæ, without affecting any transparent adjacent fibres. These surfaces, however, discharge white, glairy mucus, which will not form the adventitious membranes. As the catarrh advances, these secretions become thicker, yellower, and easier expectorated. It seems to contain globules of pus, but is free of serum, which is present in croup. If it were possible to reduce incipient tracheal inflammation into a species of catarrhal, by extending the more confined and *cartilaginous* inflammation of the former, into the more diffuse, superficial, and curable nature of the latter, then a very great improvement would be effected in medicine.

14. Is there reason to believe, from the experiment related page 168 of this treatise, that if a weak and well regulated mixture of *ammoniacal gas*, atmospheric air, and vapour of water, were inhaled for a long time, fibrinous formations, or adventitious membranes, might be prevented; or, if forming, their texture broken down, so as to be easily expectorated or detached.

That the ammonia, so diluted, may be safely inspired, we know from having tried it: that it is potent, may be concluded from the following proofs, which we here subjoin, as well to show the practicability of our suggestion, s to enable every person to act in cases of emergency, from the mistakes and suicides consequent on the abuse of prussic acid. Though the *Lancet*, which contains the following, is deservedly in general circulation, as well as the recommendations of Dr. Murray and others, regarding antidotes to prussic acid, yet, as we have spoken of the *external* use of ammonia and chlorine, we are anxious to allude also to their internal inhalation, in cases where we may be instantly called upon, and may save a life, or let it perish.

"The inhalation of the vapour from a weak solution of ammonia in water, is to be considered as one of the most efficacious means of checking the poisonous effects of prussic acid. The solution must not be stronger than about one part of the caustic liquor of ammonia to twelve of water, or it will cause a spasmodic contraction of the glottis, and inflammation of the trachea; the internal use of ammonia appears to have no effect whatever. The inhalation of the vapour from a weak solution of chlorine, four parts of water to one of chlorine, which was first proposed by M. Simeon, of the Hospital St. Louis, is not less efficacious than ammonia. M. Orfila asserts that dogs, after having swallowed prussic acid in a quantity sufficient to kill them in 15 minutes, had been saved from perishing by the inhalation of chlorine, even if it had been employed four or five minutes after the ingestion of the poison."

15. The vapour of iodine can be concentrated to any degree of strength tho patient can bear. When long inhaled, it thickens the membranes of every part of the mouth and throat, tinging them dark red, and renders them soft, spongy, and comparatively insensible. It also seems to affect the gums in the same way as mercury, when it enters the constitution. From what has been said of cuticular absorption, and what is yet to learn, are there grounds to hope, that the exposure of the naked body of a patient, in croup, to the compound vapours of mercurials and iodine, raised by heat, might impregnate the system suddenly, so as to hinder the evolution of fibrinous constituents in excess?

16. In what proportion of cases is the preternatural or tubular membrane found within the trachea? Well marked cases are described, where no such obstruction is found on dissection after death. Is the congestion observed in the lungs and brain, after croup has proved fatal, owing to the interrupted, suffocating respiration causing effusion? and is this obstruction occasioned more by the presence of mucus, than coagulable lymph, as was supposed by M. Chevalier? or is the injected state of the lungs a part of the original malady itself, as Dr. Cheyne maintains, in his *Pathology of the Larynx and Bronchiæ?* This part of the inquiry is important, because, if elucidated, it would go far to determine the value of early bronchotomy.

The importance of this *operation,* in EARLY STAGES, is not sufficiently appreciated. Mr. Carmichael, my estimable friend, with his usual success, saved a woman's life in croup by tracheotomy.

Some months since, having been called to see a child, when two days in violent croup, though I saw it was too late, yet it being painful to stand idle, looking at the last glimmering lamp of life, I resolved to keep the child's mouth and nose over the vapour raised from ammonia and water, to give a chance of detaching the strangulating contents of the trachea. Aware, however, how near death seemed hovering about the livid lips, and how cautious a medical man should be in such a case, I requested a respectable surgeon of this place to see the child, and, on our way, mentioned to him what I proposed to try, and the reasons on which I founded the suggestion. But, observe how uncertain are all our hopes,—how easily frustrated.—How readily the remedy would have met its condemnation, if used a few minutes sooner, and the child instantly to die. On our arrival at the house in Edward-street, the fine little infant, lately so engaging and playful, had been absolutely suffocated in a spasmodic struggle, during a fit of stridulous inspiration.

This is the disease which demonstrates how far our resources fall below our desires. If ever the mind, acutely meditating, bitterly feels the tremendous truth of art's imperfection,—"it is here, it is here."

If I were not already afraid that this little treatise seems threatened with the danger of touching too many topics, or treating "*de omnibus rebus*," I would say a few words regarding the operation here alluded to. The necessity of a new passage for the air, is, however, so important and urgent on sudden emergencies of choaking or threatened strangulation, either from accidents or diseases, that I cannot resist impressing its advantages on the minds of my young surgical friends. There is more safety and facility in bronchotomy, than the parade and laboured descriptions of most authors would lead us to believe. It should be strongly urged, that thousands die for want of its early performance, for one who perishes on account of the operation.

The method which I recommend is prompt, safe, and simple. It consists of two parts,—

First.—Lean the patient's head *forward* to relax the skin on the fore part of the neck. About an inch below the thyroid gland, embrace, longitudinally, a piece of the integuments between the fore-finger and thumb of the left hand, and, with the right, cut out this oval piece of skin and subjacent fascia, at one sweep, down to the trachea.

Second.—You now lay *back* the patient's head, to make the trachea protrude forward, and you have a space of the anterior part of the tube clean and bare, corresponding in size to that of the integuments you had pinched up and cut out, which should measure an inch down along the throat, by half an inch across, at the middle. You now introduce a hook, or a tenaculum, into the middle of the exposed part of the throat, between two of the rings; you fix it, and pull forward the centre of the trachea, and at one cut, you slice out the piece which the hook has fixed, and which should be more than *half* the diameter of a silver sixpence.

This leaves an aperture which will not instantly close up like those having flaps and corners; the bleeding integuments being retracted some distance from the orifice, do not fill it with blood, and there is a ready admission for blowing in air, if required, or sucking out any viscid or membranous matter threatening strangulation.

The advantages of pulling forward the integument are, that you cut out an oval piece exactly the shape you wish, at one stroke of the scalpel, so as to leave the corresponding spot of the trachea clean and exposed.

That, when you have pinched up the integuments, you can feel the pulsation of an artery, which, by any deviation of the vessel from its ordinary course, might cross the part, and you can therefore avoid embracing it in the piece to be cut out.*

That, by drawing the skin, cellular membrane, and fascia, out as far as possible, the small thyroid vessels, which must be cut, are put upon the stretch so much, that after the piece is removed, they retract, so as to give no alarm or annoyance by bleeding.†

That, by drawing forward and steadily retaining the part to be cut on the hook, no start, spasm, coughing,

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* Desault saw the carotid artery wounded in this operation, as formerly performed. Mr. A. Burns has a cast showing an instance of the right carotid crossing the trachea two inches and a quarter above the top of the sternum. Scarpa, and others, describe cases of the arteria innominata running far up in front of the trachea, before the carotids diverged.

† Van Swieten describes the danger of blood flowing into the new opening.

or unsteadiness of the patient, can risk the knife touching the left subclavican vein below, the lobes of the thyroid gland above, either of the carotid arteries at the sides, or its point wounding the back of the trachea behind.*

That, in this mode of operating, the integuments cannot be drawn over the new orifice, by any convulsive motion or spasms, as Vigili saw in the case of a soldier; that they are not in the way, either in introducing the pipe of bellows, or a canula; and that they easily permit the sucking out of tough phlegm, or croupy membranes, when suffocating the patient. Moreover, the operation can be finished so instantly in this manner, that the most immediate chance for life is afforded.

THERE is a disease in which I have noticed particular good effects derived from the inhalation of iodine, as strong as the patient can bear. I think some authors have called the complaint *Œdema of the Glottis.*† Whatever the name be, the nature of the case is nearly as follows:—

You are suddenly sent for by a lady, who sits in considerable alarm, surrounded by her family and servants in great agitation. She tells you, that, owing to a very common habit, and a very foolish one, she keeps pins in her mouth when dressing, that one of them "went down with her breath, which she did not know till she felt it sticking in her throat, when she tried to swallow." She is perpetually renewing this effort, and directs her finger

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* Fabricius ab aquapendente shows the injury resulting from touching the back of the trachea, even with a canula.

† L'Odeme de la glotte.—BAYLE.

to where the point and head of the pin are fixed. You lay back her head, depress the tongue, look into the pharynx, and top of the larynx, but you see no pin. You find the mucous membrane, however, red, and patches of soft pulpy villi inflamed. But she tells you this appearance was occasioned by endeavours to withdraw the pin, which she can easily feel across the root of the tongue.

On introducing the finger, there is a tumour felt around the aperture of the glottis. You insist there is no pin, or other foreign body. You explain how she has no suffering during the expiration; whereas, if a hard or sharp substance were fixed in the part, the pain would be constant, or at least renewed on every kind of motion, as well as that of inspiration. But the patient answers all your reasoning by thrusting down her fore-finger again, feeling the edge of the os hyoides, or corner of the cartilage near the aperture; she is more and more convinced, in her own opinion, which her sensation of pain certainly strengthens.

Some expert practitioner, famous for extracting pins from the throat, is now called in. The experiment is tried with sponges tied to whalebone. Raw eggs are thrown into the stomach, and then emetics given to throw them up again. These eggs, it is affirmed, will wisely carry out the pin, on the simple principle, that Sinbad's joints of meat entangled the great gems out of the valley of diamonds.

This *tender* usage of a delicate patient, for it is in such it occurs, aggravates the disease. Inspiration becomes almost impossible, the tumor more soft and vascular, the voice hoarse, guttural, and suppressed,—the countenance is marked with a character of consternation,—fits of intolerable distress, and anxiety return at shorter intervals. During some fruitless effort to discharge, or extract the supposed foreign irritation, the afflicted lady suddenly throws herself back, and is dead.

This is, fortunately, a rare case, and its cure is very difficult. But repose, constant and unceasing inhalation of warm vapour, and afterwards of iodine, to remove the sensibility of the swelled part, is the best measure I can recommend, along with such constitutional regimen, and prudential restraint, as circumstances may indicate, and attention direct.

Catarrh.

THE complaint called Catarrh, to which allusion was made before, is usually a more general, but a more safe diffusion of inflammation, and secretion of the immense superficies of the tubular linings, through which the air is respired. Sometimes a certain peculiar temperament of the air, in spring or autumn, will render whole districts or kingdoms liable to be assailed by it. It is then said to be infectious, is called influenza, and is accompanied with smart febrile symptoms, and such other sensations as attend a bad cold. There are some very complicated and malignant characters of this complaint, and certain very bad popular modes of treating them by hot fires and warm punch.

Animal food should be avoided, when thirst, heat of skin, pain of head, or other febrile symptoms prevail. Large dilution, diaphoretics, aperients, and last, not least, the warm bath may be mentioned, though it ought to be the first thing resorted to.

Fully aware how odious it is to talk of the same remedial processes in so many disorders, however similar, and even affecting the same tunics, I must quote some authority occasionally, to ward off the very irksome symptom of egotism, which is far more *painful* and *incurable* than any of the numerous incipient sensations of Catarrh, unless they turn out peculiarly obstinate indeed.

Dr. Thomas, a very popular writer, says: "Much benefit has been derived in some cases of chronic catarrh by using a warm bath, but particularly the vapour bath, as by the latter we have the power of introducing into the chest soothing or stimulant vapours, which act immediately on the seat of the disease. When the secretion from the chest is greatly lessened, and debility alone remains, we may alternate the vapour bath with the cold one, using the latter twice a-week, and the vapour bath once."

Phthisis,

OR PULMONARY CONSUMPTION.

WITH regard to the classification of this disease, or rather consequence of diseases, if it serve any good purpose in practice, we would incline to place it under the class MUCOSÆ, for the following reasons:—That, in nine cases out of ten, phthisis has commenced in the mucous membranes and their follicles, or in tubercles in their substance, and that it is very generally a continuation or consequence of bad cases of *catarrh*, *measles*, *hæmoptysis*, from blood exhaled on the mucous surfaces, and also of *asthma*.

THOUGH MEASLES belong to a different class and order from the above, yet in certain cases the respiratory tubes are considerably thickened and inflamed. This is shown by the sharp, dry, tickling cough, sneezing, and defluxion from the eyes and pituitary membranes of the nose. In bad cases, there is a sense of constriction around the chest, with a feeling of weight or oppression, frequent sighing, with restlessness and anxiety.

These symptoms become much aggravated, where accidental exposure to cold has retarded or arrested the free appearance of the eruption on the skin. In this case suppressed voice and hoarseness are particularly vexatious.

In bad cases, where the rash did not appear, and where pectoral disorder prevailed, the form of inhalation already mentioned, produced marked and immediate relief. With half the quantity of sudorifics, free and copious perspiration was induced, the breathing became relieved, cough and pain of the breast diminished, and in a short time the face, neck, and body, were covered with clusters of measles.

But where the complaint has been neglected, and the dyspnæa continued longer than the sixth or seventh day, the skin dry and parched, and the general pneumonic disorder unabated, then we have reason to dread the consequences which occasioned our casual mention of measles. We soon after find that, with hectic fever and aggravated cough, the disease is merging fast into consumption.

The measles often induce phthisis more indirectly, by exciting a scrofulous sensibility, or a tubercular irritation, which otherwise might have lain dormant and inactive.

The sympathy, or continuous extension of mucous vascularity and inflammation, which accompany scarlet fever, are seldom causes of consumption; for here there are more defined boundaries to the inflamed state of the tissues, and the redness is not so extensively diffused as in measles, but is more confined about the palate and throat.

Catarrh has been mentioned as another much more common *cause* or *precursor* of *consumption*. Of this general disorder we spoke, in its milder form, in page 241. Here, however, we refer to it again as a source, or rather a component part, of a much less curable complaint. When, in place of a slight degree of fever, we have considerable constitutional excitement; when, for a soft cough, with free expectoration, the fits are violent, hard, and dry, with difficult discharge of ropy slime; when the very first stage, as well as the second, assume the more defined stamp of *pulmonary catarrh;* when the case is mismanaged and protracted, the skin arid, the interior and upper part of the chest hot, and feeling as if scalded; when this sensation is felt as if diverging to the right and left sides of the lungs, and the breathing is short and quick,—and when, as the affection advances, there are more distressing fits of irritability, and coughing, if cold weather and frost set in;—if we have sometimes flushings of heat,—sometimes thrills of cold,—if the sputum be so thick or glutinous as to cause great distress in its expectoration, and when it can be extended, it is tenacious, clear, and transparent, like a cord; or when the glairy fluid is mixed with some dull striæ,—if as the disease proceeds, the expectoration become freer, thicker, aud yellower, with greater pain, and anxiety, and hectic flushes, and night sweats, and wasting of the body, with soreness between the shoulders, burning heat in the hands and feet, and general debility and marasmus, then the philosophical distinctions between pus and mucus, and the demarcation designating such a progress of catarrh from a consumption, will little avail the victims to whom either of the affections are almost certain to be fatal.

It is, however, very essential to be able to judge, whether lesions of the lungs be temporary, or whether they be owing to disorganization.

The stethoscope is very important in assisting us to investigate the differences, as is our duty, so far as possibly can be done, both for the sake of our patient, and the character of our own discrimination. In the first stage, when the catarrh is dry, there are various parts of the affected lung liable to emit no respiratory murmur: this occurs where the scanty secretion obstructs the passage of the air, for an instant, in those parts of the bronchiæ; but as these obstructions move on, and leave those parts of the pipes clear, by retaining the stethoscope in the same place, you will soon hear the murmur of respiration renewed in the air tubes; this communicates the sound called "*rale sibilant.*" This hissing noise disappears as the ducts are cleared, by coughing or sneezing, but returns again when the viscid excretion fills them up. The "*rale sonore*" indicates a change of structure in the bronchiæ themselves, or in their lining membranes, and, is, of course, stationary at that place.

In the first stage, the inhalation is best from the water alone, or from a strong infusion of hops, which, if its being placed in the bed, and in pillows, can invoke sleep to the delirous patient in fever, may not unreasonably allay irritation and relax spasm, if capable of diffusing its sedative qualities, for five or six hours, to such a large and now active extent of soft surface, as all the linings of the convolutions and ramifications of the air passages present. Here, also, as the pulse is quick, the vapour should not be hot.

In the second stage, where activity is less, and danger of disorganization and altered structure more, then the vapour should contain iodine, as much as the patient can bear without exciting cough, and here the vapour should be warmer.

This is particularly eligible (varied, of course, according to circumstances,) in that species of catarrh which afflicts old persons, after having been subject to frequent attacks of the acute form. If the patient sleep in a damp place, or the weather become colder, he is seized in the morning with incessant fits of coughing, which persist in torturing him till expectoration begins. This is renewed every day, till the sufferer is exhausted. There is not activity in the bronchiæ to throw out secretion to dilute or expel the glutinous mucous, which mechanically shuts up the air pipes, and, therefore, some exciting inhalation should be tried. How would a dilute and mild mixture of ammonia, in vapour of water, answer?

In cases like these, the skin is cold and dry, and, therefore, the long inhalation of hot vapour will fulfil two or three indications, besides that of thinning and washing out the glairy, albuminous matter, which otherwise would accumulate, and become more and more consistent, so as at last to resist the admission of sufficient air to keep the man alive.

Enlargements, and scrofulous thickening of the mucous folliculi, or cryptæ, are frequent proximate causes, or indeed symptoms, of those disorders in the respiratory canals, terminating in phthisis. The mucous membranes are studded with minute spherical bodies slightly elevated, having an orifice at the top, leading to a small sac or shut hollow; from this cavity a fluid oozes out. These bodies having been supposed destined to secrete the mucous fluid, were called *mucous glands*.

In strumous habits, when these follicles are excited by cold, over-exertion, foreign irritation, the use of mercury, or activity of other diseases, they swell, distend the membrane around them, and compress the subjacent parts, excite heat and pain, and at last discharge purulent matter.

As subject to the influence of similar treatment, so far as constant inhalation of warm decoctions are concerned, we may here say a few words of TUBERCLES.*

Those little "*millet seeds*" of death, though not properly confined to mucous organization, are like the enlarged or ulcerated cryptæ above-mentioned, most intimately allied to that disposition of the constitution called scrofulous: excitable by similar causes, and by the memechanical irritations of hard particles, which artificers are liable to inhale in the breath.† Violent chemical excitants also rouse their occult sensibility;‡ or, perhaps, to speak much more philosophically, generate them de novo; for it is probable, that the same causes, capable of exciting tubercles, when present, might be sufficient originally to produce their *mushroom matter*, in parts partaking a good deal of the same chemical qualities.

These small tumours have been called accidental tissues, being some production different from that of any of the natural ones. This morbid structure may affect all the organs; and, in truth, where it is found in one, it is frequently met in another. They are sometimes found surrounded with a peculiar membrane like an encysted tumor, and sometimes intimately blended in the surrounding matrix, as if made up of it. They vary in size, from that of a millet seed to a small egg. When latent, or not increasing, they seem devoid of vessels or sensation, and cut like cartilage or cheese. In process of time some change takes place, by which they soften in the heart, and at length suppurate, and leave ulcerated cavities. Though the analogy does not exactly hold, yet it is so similar between the pith and progress of these kernels,

* Grandines of Weffer.

† Dr. Johnson, Memoirs Med. Soc. vol. v.

‡ Dr. Willan's Med. Reports.

and of certain glands, and their hereditary character, and indeed mutations and revulsions have been so long and so accurately observed, as fully to justify the following conclusions:—"Tubercles are the most general cause of consumption; in nineteen cases out of twenty, they depend on a scrofulous habit. The connexion between scrofula and pulmonic consumption is obvious, and generally acknowledged; the latter being often no more than constitutional symptoms ingrafted upon the scrofulous diathesis. At the time when scrofula disappears from the surface of the body, it frequently falls upon the lungs."

"In noticing the causes of the vast prevalence of phthisis pulmonalis, I think I may put down the increase of scrofula among us, and we therefore meet with more cases of tubercular consumption than of any other kind. The predisposition to scrofula is inherited by children from their parents, and at some period or other of their life the disease shows itself either in inflammation of some gland that suppurates and breaks externally; or in tubercules in the lungs, that proceed to suppuration and ulceration, and terminate in consumption.

"That consumptive mortality has very considerably increased in Great Britain within the last century, cannot be denied; and according to the calculations of a modern writer, the annual victims to consumption in this island are not less than fifty-five thousand persons out of a population of eleven millions."*

The following being the general outline of tubercular symptoms of phthisis, are those most commonly met with in this country. It is maintained, and I believe *truly*, that persons of fair hair, blue eyes, large upper lips, and thin skin, are not more subject to scrofula than persons of any other appearance; yet, undoubtedly, though those

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* Thomas.

of the above aspect are not more liable to glandular affections, externally, yet there is some peculiarity or delicacy in their skin, and, of consequence, in the mucous membranes, which renders them more susceptible of sudden suppression of cutaneous and mucous secretions, than those whose texture is more robust. A person of this fine fibre is easily affected by changes of temperature, and readily subject to slight colds. Their frequency occasions them at last to be overlooked, until continuance of short, dry cough, hurried respiration, inability to run up a stair, or take the customary exercise or amusement, from a feeling of straitness and oppression at the chest, begin to remind the unsuspicious youth, that the last cold is much more tedious and troublesome than those that went before it. An anxious parent, or some relative, now perceives that the shoulders stoop forward, and are raised up more than usual on inspiration; that there is a hard cough, but no expectoration; dejection of spirits one time, animated excitement at another; that, in the middle of some playful speech, there is an interval to take in air; a sigh seems first to give pain, and then relief; that appetite is bad, and a wish for cold drink; and that there is a desire, on some occasions, of sitting near the fire, at others, of being cooled by free exposure to the air.

A thing injurious to the human body, is hurtful several ways. If a lady be affected as above related, she attributes the circumstances, particularly the constriction about the chest, to tight lacing; and she expects, that when the cause is removed, the effects shall cease. Reading ancient Chaucer, she finds this aphorism:—

> "The best, said he, that I can you advise,
> Is to avoid the occasion of the ill;
> For when the cause, whence evil doth arise,
> Removed is, the effect surceaseth still."

Expecting, daily, the disappearance of her complaints with the removal of her pressure, *there is time lost,* and the consequences still remain. *Exercise,* and *early rising* which has sent many a victim of consumption to an *early* grave, are next resorted to. Repose, sleep, and perfect rest, might have given the disturbed tissues time to regain their former condition. But weak and languid as the lady is, and cold, and sharp, and injurious to her, as is that morning breeze, so salubrious to the strong and the sound, the love of health, and dew, and the famed restorative powers of long walks, and the desire to obey the recommendations of her friends and advisers, induce her to leave her warm bed, to exhaust her little remaining strength, to seal up her skin and lungs in the cold atmosphere of the morning, to hurry her pulse and her respiration, and, on her return, spiritless and overcome, to mistake the glow of over-exertion and weakness on her cheek, for the blush of returning health afforded by the dawn.

The febrile disposition is more increased by the motion. The second stage begins to set in; and whether the tubercles excite the mucous membranes, or these the tubercles, there is a large secretion of frothy albuminous fluid, which is sometimes streaked with blood, particularly after exertion. Breathing now becomes more difficult, and the body is wasting and weaker. There is pain in the side or front of the chest, increased by coughing or deep inspiration, with inclination to sleep on one side rather than the other. It is probably only at this time, when the blood is seen to tinge the mucus, and the pain of breast is oftener felt, that the pulse is submitted to examination. It is found quicker than the symptoms would seem to account for; the phlegm, tough, albuminous, and bulky, is expectorated in large quantities; the voice becomes hoast and hollow, the head is elevated on the pillow, the palms of the hands, the soles of the feet, and centre of the cheeks burn; the lips fill with florid blood; and, as if one part had lost what the other had gained, there is a circle of pure white outside the crimson lips, as if this portion of the vessels became too small and empty, when the other was too large and full. As if the army of red globules had left the exterior camp, and crowded round the circle of the citadel. Nature, too, would seem desirous to make up for the brevity of her benefits, by the beauty of her favours: whilst absorption turns the teeth to pearls, hectic sets them in a ring of rubies. The rose is glowing on the blushing cheek, and its dye is deeper from the lily which surrounds it: the eye is flashing with unusual lustre, and the large expanded pupils flash brightly as they beam.

The mind also feels the fervour which consumes: the spirits are exhilerated, the heart seems "lightly sitting on its throne;" liberal hopes of future pleasures are indulged; whilst the dress, the ball, the next new work of Mr. Moore, are all reviewed in fancied anticipation. There is, besides, a happy oblivion of painful recollections and of injuries. The soul, before it takes its flight, has time to expand already, to break the bitter bonds around it, to advance on its upright way to heaven, disenthralled and disentangled, and to demonstrate how high it shall shortly soar, above the troubles and anxieties to which our voluntary follies so easily subject us.

The consuming malady, in the interim, runs on; ropy mucous is now intermixed with globules of yellow, greenish, or keely matter, the expectoration becomes easier, thirst ceases, the skin is cool, except in the evening and before morning, when fever follows a fit of shivering, and is itself succeeded by clammy and debilitating perspirations. At every cough a quantity of suppurated fluid is thrown off, emaciation more and more wears away the body, and, as if to hasten its progress, the mucous membranes of the intestines take hold of the disorder, and become, probably, affected with the very same disease. Diarrhœa distresses, whilst it debilitates. Colliquative perspirations likewise aid in melting away the victim of consumption. As if to give our feelings deeper pain, the warmth, and the opiates, which would ease and compose the bowels, will augment the too ready disposition to diaphoresis. On the contrary, if we endeavour to diminish the latter, we add to the active condition of the former.

The further progress of tubercular phthisis need scarcely be repeated. They are the well-known precursors of dissolution. The hollow and languid look, the swellings of the feet, the feeble voice, as if drawn from an empty vase, the wasted and decayed flesh, and prominence and defined shape of the nearly naked bones, all reconcile us, in some measure, to that separation, soon to deprive us of those we held most dear.

THE treatment will little avail, unless during the first or beginning of the second stages; and then, if the patient can bear it, moderate depletion and antiphlogistic regimen, may prevent the enlargement and consequent pressure of the tubercles. Internal medicines will convey little remedial benefit to the kernels themselves, except in so far as an early use of diaphoretics, and aperients, serve to abate general excitement or local irritation. Medicine poured into the stomach, mixed up in the passages, altered and blunted in the blood, may easily pass through the lungs, without coutributing to alter their diseased texture, or prevent the enlargement of the adventitious tumors, called tubercles.

With regard to topical applications, they have been so numerous, and often so absurd, and so ill and inefficiently applied, that it is no wonder any novel kind of fomentation is depreciated by some, and dreaded by others. It appears, from what was said, that the simple vapour of water, not *as formerly mismanaged and misapplied*, but copious and continued, will prove the best local auxiliary we can employ. Some of the advantages of these ablutions of the lungs have been already glanced at; and though generally applicable to other affections of these organs, will be found particularly so to the species of consumption now under consideration. It would be tedious to enumerate all the benefits derivable from various modifications of aqueous and sedative vapours. A few, however, may be brought under observation.

1. The madefaction of all the membranes, air-cells, cryptæ, and tubercular structure.

2. The preservation of uniform temperature during winter, in our variable climes, without the parching and exciting properties of a naked fire, or dry stoves.

3. The agreeable softening influence of the water diminishing inflammation, which so much irritates the glands and mucous follicles of the bronchiæ. The emollient fomentation abating the tickling, greatly alleviates the cough, which is itself a new source of additional injury. Severe fits of coughing agitate the lungs, open up new sources of exulceration, produce, or at least exasperate the tubercles, interrupt sleep, and discourage the patient and attendants.

4. Confinement to this plan enforces a proper attention to regimen, and makes an impression on the visitors, calculated to prevent their numerous prescriptions, and to show that the patient is not to exercise the lungs in speaking or singing, nor the body by any active exertion.

5. The dilution of the mucus, and its discharge and

detachment from the pipes, are also good effects of the inhalation of water in vapour.

6. Where the matter expectorated emits a smell disagreeable to the patient, or where any aversion may be evinced to the iodine where it is used, vapour will convey any fragrant flavour of roses, or any aromatic added to the water.

7. As was before stated, it is important to maintain an atmosphere loaded with warm moisture, in cases of irritability from tubercles, or any other cause in the lungs; for the sharp air of the sea, or of high, dry situations, though salubrious in other respects, yet stimulates the diseased organs of respiration too much, when already excited by tubercles, or any other source of suffering. Many cases could be adduced to strengthen this position. The son of one of the Marquis of Donegall's gamekeepers enjoys good health when he resides in the low valley; but instantly becomes affected with violent cough and spitting of blood, when he removes to a very elevated situation on the Cave-hill. Clapier relates a case of confirmed phthisis cured by habitual residence in a coal mine.* Bergius praises the thick vapour of the breath of cows for consumption. It is a common practice for phthisical patients, in Flanders, to remove to the marshy parts of the country. Dr. Wells has shown, that wherever intermittents are endemic, consumption is seldom seen.† The authority of Dr. Cogan, who resided in Holland, is adduced by Dr. Beddoes, to prove the infrequency of coughs and colds among the Dutch. In the fenny parts of Lincolnshire, pectoral diseases are rare.

Richerand, (page 200,) says, "patients labouring under pulmonary consumption, prefer the thick and damp air of low situations, to the sharp and dry air of mountains."

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* Journal de Medicine.

† Trans. Med. Cir. Soc. vol. iii.

WITH respect to medicated fomentations, I can safely affirm, that if iodine cannot effect a perfect cure in advanced stages, it is capable of procuring decided relief from pain, and disposing the patient to repose, when the tubercular nodules have suppurated in the centre, and open into the neighbouring bronchiæ, or when they unite into large abscesses; then the free use of iodine in vapour has improved the condition of the parts, so as to alter the discharge; and where the cavities were not extensive, or the tubercles opening in successive crops, restoration to health has sometimes taken place.

The same result occurred lately, to a remarkable degree, in an instance of vomica consequent on pneumonia.

The consumption which is only a termination of pleurisy, or of inflammation of the lungs, will be benefitted by the same remedial measures, so far as regards the mitigation of the malady in point of suffering. The *cure* is seldom practicable. *Prevention* is the only true and useful benefit we can in such cases expect to confer, before the melancholy disorganization has taken place.

They who will reflect on the wonderful structure of the elastic lungs, and their more astonishing functions and uses, will not be surprised at the frequency of their lesions, and the difficulty of their restoration to a state of salubrity. Over and above the all important mechanism of being the medium of a vacuum at each inspiration, and of regulating the circulation of the blood, and alternately filling and emptying the air vessels, Etmuller recounts the following uses of respiration:—

"1. Ad olfactum. 2. Ad screatum et sputationem. 3. Ad oscitationem, tussim, sternutationem, emunctionemque. 4. Ad liquidorum sorbitionem, suctionemve. 5. Ad loquelam, cantum, clamorem, risum, fletum, flatum, etc. 6. Ad fœcum alvi, urinæ, fœtus molæve, necnon secundinarum expulsionem. 7. Ad promovenda ventriculi, intestinorem, lacteorumque vasorum, etc. contenta. 8. Ad halitus aqueos sanguinis e pulmonibus, æris, ope, exportandos. 9. Ad diapnoen. 10. Ad exactiorem chyli, lymphaeque, necnon sanguinis miscelam. 11. Ad conciliandum sanguini coccineam rubedinem, etc. 12. Nec morose negabimus ærem pulmones et sanguinem illos transcurrentem, minus calida reddere, etc. 13. Quod denique aer sanguini singulis respirationibus aliquantilla sui parte, admixtus, paucissimas quasdam in spirituum animalium elaboratione particulas simul contribuat."*

September 24th, 1829.

Miss R., a fine young lady, of delicate countenance and slender form, aged sixteen, about two years since suffered severely from cough, occasional headach, and debility. Change of air and proper caution removed these complaints till about three months ago, when she was unfortunately exposed to cold and wet, on a journey in Scotland. She seemed in a great measure to have recovered from the effects of this cold, when it again returned with increased severity, occasioned by sleeping in a damp bed, on her way to England.

Having continued to become imperceptibly worse, from pain of chest, heat of skin, cough, weakness, and loss of appetite, she returned from England, in a very exhausted state indeed.

On her arrival at Belfast, I was requested to visit her in consultation with Doctor Forcade, Staff Surgeon. The following notes, taken by me, are extracted in the

* Etmul. Dissert. 2. cap. 10. sect. 1, et 16.

extemporaneous manner they were entered from time to time:—

Sept. 24th. The appearance of this patient is so changed, that we could scarcely recognise her. Her colour altered, emaciation remarkable, and general aspect anxious and disturbed. The cough is short, hard, and frequent, no expectoration, acute pain of right side, under the fifth, sixth, and seventh ribs, which extends round under the scapula, and affects the right shoulder. This pain renders her quite unable to take a deep inspiration. Breathing is short, confined, and hurried, pulse 130; skin dry and hot, tongue white in the middle; thirst.

There is a total inability to walk or take exercise, as well from debility as the quick respiration. She is unable to sit up any length of time, or to lie on the right side; there is a distressing sensation of tightness or constriction across the chest, as if compressing it, with a feeling of great heat in the side affected. The bowels were said to be in general constipated; other secretions scanty, catamenia per tres menses absunt. Sleep disturbed and restless.

Repose being essential after the journey, pediluvium was prescribed, with some cooling aperient medicine, and rest and quietness particularly enjoined.

25th. On examining the sides and chest, there is no pain on pressing the region of the liver, stomach, or other parts of the abdomen; no external pain of the pectoral parietes, but that under the ribs worse; percussion gave a dull compact sound on the part affected. The stethoscope indicated the respiratory murmur free in the left lung, approaching to *puerile*, and rather more so at the upper or clavicular portion of the right lung; but in the centre of that side this murmur was altogether suppressed. This was quite obvious both to Dr. Forcade and myself.

The cheeks which were yesterday crimsoned with a circumscribed flush, are now pale and bloodless; alternate rigors, and febrile exacerbations succeed, with heat of the hands and soles of the feet; no perspiration, except a clammy softness at night, after severe heat of skin; no appetite, sometimes inclination to vomit. When the fatigues of the journey had gone off, finding the pain of side increased, twelve leeches were applied, and the part kept bleeding a long time, encouraged by warm fomentations.

26th. The pain still worse; a large blister applied. This having risen well, was poulticed; the bowels were attended to by mild saline aperients. For the constant, hard, dry cough, various expectorants, such as squill, syrup, mucilaginous mixtures, and other demulcents, were prescribed, but without any benefit; pulse daily averaging 117, small and weak; breathing short and quick, nights restless, no expectoration, debility precluding further depletion, though the pain is still severe.

On the night of the first October, I was suddenly called to attend, and found the distress from the incessant cough much aggravated, pain of side acute, breathing short, confined, and forty in a minute, pulse 130, but very small and thready; no expectoration, half an hour's coughing only bringing up a little saltish, glairy froth.

At this time, hot febrile exacerbations regularly recurred every evening, and again before morning; skin, after the cold and shivering, becomes very warm and arid, remaining parched, until a kind of perspiration breaks out in the middle of the night.

The advantages of the iodine vapour having been apparent to me in other cases of similar pectoral diseases, I determined, *however hopeless*, to prepare for its inhalation, by first using the simple vapour of water, until the irritation would in some degree subside.

This amiable patient, anxious for relief, was unable to sit up in bed to inhale vapour, and as at this time it was desirable to avoid any appearance of apparatus, a jug of hot water was placed close to the end of her pillow, by pushing back the corner of the feather bed, and placing the vase in the hollow, so that the pillow covered part of it, on which she then lay, and inspired the steam as it ascended densely about her face.

She was directed to admit more or less air, by covering or uncovering the head, as her own feelings would direct. Where pain, on extension of the thoracic parietes, is very severe, the vacuum made for the inspiration seems to be filled more agreeably to the patient, by warm aqueous vapour, than by cold atmospheric air alone.

The great distress she previously endured, and the soothing relief she now experienced, encouraged her to persevere for some hours during the night. On Dr. Forcade's return to town, we saw her next morning, and were much pleased to observe improvement in some respects. The skin is softer, pulse 120, weak; tongue clean, fauces and palate less parched, cough greatly abated, pain of side still acute. For the *first time*, she has expectorated, during the night, about two ounces of mucous matter, which is so tenacious, that it does not fall from the inverted cup; on being drawn up by the fingers, it forms a transparent glairy rope.

Oct. 2d. The inhalation regularly continued three times daily, for two or three hours each period: though sometimes shivering and feeling very cold, yet soon after beginning to inhale, when the vapour is confined about the face, heat begins to diffuse itself through her limbs, and her skin becomes moist. Thick mucus is now copously discharged at every fit of coughing. There are rigors, at intervals, succeeded by great heat, and at night by clammy perspirations; pulse 115,—shining hectic of one cheek, again of the other,—flashing of the eyes,—pearly whiteness of the teeth,—and the look of anxiety, mingled with resignation, impart to the countenance a character of interest and concern, with which every one who sees her must be sensibly affected.

3d. Pain of side less severe, no appetite, expectoration about four ounces daily, still *albuminous* and viscid, and contains yellowish striæ, without any odour.

4th. I this day mentioned to my friend, Dr. Forcade, that the irritability having somewhat subsided, and as I had by this time many decided proofs of the efficacy of IODINE VAPOUR, as well in disorders of the mucous membranes of the bronchiæ, as of the eyes and nose, no time should be lost in commencing its inhalation in a disease like this, so *unequivocally evinced*, so *far advanced*, and *so evidently out of* the *reach of any benefit from medicines taken by the stomach.*

Doctor Forcade instantly assented, and as the patient was still easily agitated, and, indeed, had expressed great aversion, even to a repetition of the stethoscopic examination, we resolved to avoid the appearance of apparatus.* We, therefore, thought it advisable to let her breathe the *iodine*, diffused in the vapour of the water, in the manner to which she was so much attached, from the alteration evidently produced by the simple vapour itself.

5th. Five grains of iodine were diffused through two quarts of water, at 160°. Over this she kept her head covered, as near as convenient, and inhaled the vapour for an hour. The iodine vapour must not be used strong at first, whilst symptoms are acute, as it would evidently excite, when topically applied to the lungs. This might be prejudicial in pleuritic affections, or diseases of the

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* Persicos Odi puer apparatus.—*Horace.*

class SEROSÆ; but I am of opinion it is not hurtful in the second stage of inflammation, in the class MUCOSÆ, we see how excitants alter the state of these membranes. Mr. O'Halloran, and many other military surgeons, recommend, strongly, a weak solution of nitrate of silver, as a certain mode of inducing a new action on these tissues on the eyes, and arresting their inflammations. We cannot, however, admit of any exciting vapours being used strong or pungent, where there is irritability and over-excitement of the bronchiæ.

Miss R. certainly had suffered from a partial affection of the pleura, as is evident from the acute pain of side, so sensible to inspiration; but from the other symptoms and albuminous secretion, it is plain the bronchiæ are affected: her voice is peculiarly hollow and boast in speaking. The smart degree of fever, the aspect of the patient, and the previous history of the former complaint of the chest, leave little doubt but there is tubercular disorder also.

6th. The inhalation was repeated thrice, for an hour each time, since yesterday; expectoration copious, pulse 112, feeble, general debility, want of appetite, *sleeps much better*.

7th. As yesterday, continues the inhalation, five grains of iodine occasionally added to the same water, which is heated for each fumigation in a close vessel. The apart-smells exactly like the wrack on the rocks, in the hot sun, after the tide recedes.

If the *iodine* be found to contribute the advantage of the sea air, without its piercing cold and inconvenience, then one great desideratum will be gained, that is, *to bring the sea to the patient, not the patient to the sea;* and, in like manner, by the genial warmth of the vapour, *to bring the temperate climate to the sick; not the sick to wander in warmer latitudes abroad.* So dense is the vapour with the new fumigation, that it has dyed her cap a deep yellow colour, which, however, disappears, on exposure to the air; perspirations now break out easily during each inhalation; this gives her at least temporary relief, and, as she says, takes the tightness off her chest. Bowels rather confined, a weak saline solution ordered, with cream-of-tartar water for drink. Food from the beginning, gruel, panada, milk-porridge, coffee and tea (not much used), and arrow root.

8th. Pulse down to 100, cough less frequent; spit, thick glutinous mucus, *sometimes tinged with blood.* This is expectorated with little trouble; quantity of sputa about three ounces daily, still so viscid, as to adhere to the inverted cup.

Evening visit.—This young lady is much better, wishes for her inhaling vase, over which she can now recline two or three hours with pleasure; pulse down to 98, but still weak.

9th. Had a long continued shivering fit at six o'clock this evening, succeeded by a glow of hectic fever. Her mother attributes the tremor to her feeling so much better, that she sat up for two hours at the fire, and also to her nerves having been disturbed by some unpleasing news, or cause of anxiety.

10th. As yesterday. Hot fit in the evening, but no rigors. Perspired profusely after the inhalation last night; pulse, in the morning, 90; at night 100; small and thready.

11th. I being absent, Dr. Forcade saw her this morning; found her pulse 90, skin rather warmer; fomentations thrice daily, as usual.

12th. Vomited yesterday evening after the fumigation; some glairy viscid matter brought up; pulse now 80, cough less frequent, only three sputa since last night's visit; appetite improved, breathing 22, countenance tranquil, sleeps a considerable part of day and night. The iodine has affected the mouth like mercury, gums sore and spongy, tongue swelled and brown-red, throat and fauces soft and tender.

13th. Pulse, beginning the inhalation, 88, breathing 18; sputum less viscid, clear, and frothy. During fifteen minutes' inhalation of the warm vapour, pulse up to 100, breathing 19; legs begin to perspire, nostrils discharge mucous phlegm: the water used in this fomentation contained ten grains of iodine, which pained the eyes considerably. In thirty minutes' continuance, pulse up to 115; breathing, 22; the pulse rising so fast, and the vapour being so pungent, from double the quantity of the substance being used, determined me to withdraw the fumigation at the end of the half hour.

In five minutes after ceasing to inhale, the pulse fell to 106; respiration 20. In five minutes more, pulse only 82.

At the end of half an hour, the pulse down to 78, which is ten less than when the fumigation began an hour before.

14th. The mouth being very sore, the use of the iodine is suspended, and simple vapour of warm water inhaled in its stead. This morning, for the first time, the sputum was decidedly *purulent*, cough more frequent, had high fever last night, pulse 128, after severe fits of coughing; appetite very bad to-day; slept none last night; frequent sighing, and great dejection of spirits.

16th. Mouth and throat better; sputa unequivocal *pus*. Owing to the irregular mode of using the iodine at intervals only, and as the frequency of the pulse was augmented by the vapour when inhaled warm, as well as the perspiration increased, we determined to diffuse the iodine more permanently and more uniformly through the room, and keep the temperature regularly about 68°,

The Boiler, *(represented in the plate,)* was set on the fire. In the water, a small bag was suspended by a hook in the cork; in this bag thirty grains of iodine was enclosed, which began to come over at the pipe along with the steam of water, and was discharged around the patient in bed. This quantity was introduced night and morning.

17th. The temperature of the room remains steadily at 68°, when the thermometer is 50° in the adjoining apartment.

18th. Pulse 100, breathing 18; little or no cough or expectoration; slept better last night.

19th. Hectic flush, preceded by coldness; left cheek still shining, and tinted with a circumscribed flush; bowels, though formerly rigid, now loose; feels low, dejected, and faintish when she rises; pus expectorated yesterday about three ounces, in large, round globules, interspersed with a few streaks of blood; percussion on the right side of chest posteriorly on the angle of the ribs, produces scarcely any sound, but is dull and suppressed; on the corresponding part of the left side it resounds clear and distinct.

20th. Pain of side near the axilla complained of, bowels affected with all the character of colliquative diarrhæa, clammy sweats at night, cough very teazing, little or no rest, pulse, in the morning, 110; at night, 129.

22d. Symptoms aggravated; diet, small quantities of arrow root, starch and boiled milk; twenty-five drops tinct. opii, night and morning, to allay the irritation of bowels.

23d. Hectic continues; pulse this night, 139; pus thick and globular, about four ounces daily; night sweats still more copious.

24th. till 28th. Purging very troublesome, otherwise as before.

28th. One drachm of iodine put in the boiler, night and morning; heat of room 68°.

Nov. 4th. Double the quantity of iodine diffused since 28th last. Breathing easier; pulse 100; feels rather stronger.

This night the servant neglected to replenish the boiler with water, in consequence of which, a hole was burned in the vessel, and of course no steam was generated in the apartment during the night. The cough became very hard and dry, without any expectoration.

5th. Boiler adjusted, temperature of the room soon rose to 70° from 50°. In the evening, complained of coldness, and inclination to shiverings.

6th. Bad night; skin cold and clammy. Evening.—Skin now hot,—thirst,—anxiety,—total want of appetite; pulse, 115; frequent cough, little expectoration, with one streak of blood.

7th. Perspired last night, but the sweat was warm; feels better, room at 70°, pulse only 90, and fuller, iodine vapour as before.

8th. Appears much better, pulse only 80; in the evening smart fever set in; pulse 100, small and weak, skin hot and dry, face hectic, respiration 40, with dyspnœa.

9th. Fever subsided, cough less troublesome, expectoration since yesterday about two ounces; thick, yellow pus; pulse 84.

Beef-tea, jelly, a little wine and water, with fowl allowed as diet for some time.

Since the 9th till now, (30th November,) there is evident improvement. That it may continue, is most anxiously wished. Temperature of room, 68° to 70°. Thermometer, now reported by the Commercial Chronicle, 28° to 34°.

Dec. 30th. During the last month, the iodine vapour was continued, and the air of the room strongly impregnated with it. Eggs, oysters, steak, and jelly allowed; pulse ranging from 80 to 100; strength and flesh greatly improved; sleeps at least ten hours out of every twenty-four; no pain of chest, cough and expectoration nearly removed. On the whole, the improvement is particularly encouraging.

P. S.—In November, five drops of the tincture of iodine were ordered night and morning, but the use of medicine in this form was not long continued. Since that time the iodine was used only in fumigation.

HENRY FORCADE, M. D.
Surgeon to the Forces.
JAMES MURRAY, M. D.

Asthma.

NO DISEASE has been so much varied in its nomenclature as this. From Boerhave to Bree, every writer included some portion of other diseases under the general appellation of Asthma. It is very commonly characterized as one of the causes of consumption. But in most cases, where it precedes or accompanies that disease, it is occasioned by some organic lesion inducing difficult breathing, Like some of the other complications of consumption, already spoken of, asthma is seldom the cause, it is the companion, or indeed a component part of the complaint, and the same proximate origin may be assigned to both. The varieties which are confounded under this common denomination, will of course require treatment, varied according to the corresponding circumstances.

The true *asthma,* or what is understood by a distension of the vesicles, on the surface of the lungs, with breaches of their separating partitions, and a consequent extravasation of air, constituting pulmonary *emphysema,* is distinguished by the following character, and like every other altered state of the structure, and functions of the organs, may remotely, if not directly, lay the foundation of some variety of phthisis; for in truth this disorder, like asthma, is a very different complaint in different persons.

The emphysematous asthma returns to the sufferer at irregular intervals, after exposure to cold or damp, or after crude aliment, or indigestion: the habitual shortness of breathing is unequal and rapid in the inspirations; the expirations are long and slow, as if the air were pushing out by a continued pressure of the shoulders and ribs, or in fact as if pressed from the pipe of bellows by slow degrees. When the fits proceed, the respiration becomes spasmodic or convulsive, and there is a wheezing sound, as if the air were forcing through viscid phlegm; there is a constant dry cough, pushed out with an effort; the unfortunate patient becomes anxious, and there is as much of the "*miserere*" aspect, as any face of anguish can assume. In place of the air in the lungs being expelled at the expiration, it seems to rebound and re-expand the lungs, when the inspiration should take place, so that there appears a pressing or diminishing, and alternate expansion of the volume of air already in the lungs; of course there is little or no respiratory murmur, as in fact the air is not passing and re-passing in the bronchiæ; but, like that in a bladder, growing larger and smaller as the ribs rise or fall. This elastic collection of air gives the resonance which is so clear and distinct on percussion of the chest, producing a sound like that of tympanites.

Hæmoptysis,

OR SPITTING OF BLOOD.

THIS symptom of phthisis is accounted a common cause of that disease, and in fact was considered a kind of *avant courier* of consumption. Nothing more strongly evinces the necessity of some natural nosology, than the circumstance, that the whole congeries of common complaints comprehended in consumption, were allotted by Dr. Cullen to the order Hemorrhagiæ, from the usual presence of spitting of blood before, or in conjunction with the other symptoms of phthisis.

In page 34, it is stated that blood may exude on mucous surfaces, without breach of the vessels.

The general sympathetic analogy of the mucous membranes, even where not continuous, is too often witnessed in observing how the sudden suppression of a certain secretion, or exudation of a particular mucous surface, will dispose another to assume a vascularity, and to discharge blood by some kind of percolation: but glands have often exercised a similar power,—one discharging the suppressed or suspended excretions of another.

From what has been already adduced in support of the general auxiliary advantages of vapour inhalation, we may reasonably infer, that some particular fumigations will be found adapted to restore the healthy condition of the tissues. I do not pretend to have sufficient experience to determine which would be the best vapour to cover the membranes; the usual feeling would be against the use of warm inhalation:—but it fortunately happens, that almost any of the vapours can be raised by very moderate degrees of heat,—such as that of the atmosphere itself.

Pertussis,—Hooping Cough.

THOUGH considered a nervous complaint, yet we may glance at it here, owing to its relation with pectoral disorders.

If we be so fortunate as to discover a remedy for this perplexing complaint of youth, it will consist in some antispasmodic vapour, or some relaxant in the œriform state, which can be drawn in, during the long sonorous inspiration which precedes the kinks, or short rapidly recurring expirations. The vapour from decoction of thorn-apple, hops, and some other antispasmodics, should be carefully tried. Dilute ammonia, diffused in vapour of water, might have the power to thin the mucus, for when that is brought up the fit ceases. A sudden shower bath, or dashing of cold water, will cause a person to inspire deeply, two or three times; could this be effected at the moment when the expirations are so incessant, that the eyes start out in their sockets, and suffocation is threatened? There is some want of consent of action, the ribs do not rise in the proper alternate manner requisite to make a vacuum, nor does the diaphragm descend; on the contrary, they all follow the collapsing lungs, and press tighter and tighter on them, pushing out air, and taking none in, since the first untoward and preternatural quantity inspired with the origin of the fit. If we knew any mode of inducing a consent of simultaneous expansion of the parietes of the chest, the kink would immediately cease.

CAP. XV.

Gastro-Enteric Passages.

INFLAMMATORY DISORDERS OF THE MUCOUS MEMBRANES OF THE STOMACH AND BOWELS.

Having now taken a rapid review of the principal affections of the mucous surfaces connected with respiration, we will next advert to the other great branch of the same tissues, spreading over the cavity of the alimentary canal, throughout its entire length, and forming its interior tunic, folds, and convolutions.

As the influence of heat and dilution, though very considerable, cannot be so directly applied in the general treatment of these passages when diseased, our observations will consequently be brief, being only designed to excite attention to this interesting division of disorders.

It is a wonderful extension of sympathy, or rather similar feeling, that when the mucous membranes of the lungs are suffering, those of the stomach and bowels will often partake of the lesion also. In the first stage, when there is thickening and want of secretion in the air pipes, there is torpor and constipation of bowels, with want of appetite, and with thirst. Again, when expectoration freely comes on, the bowels become soft, and inclination for food returns, and the tongue is soft and clean. Lastly, when the purulent stage makes progress in the pulmonary passages, then the primæ viæ become subject to colliquative diarrhœa, which will cease and return as the pus stops or discharges. As was already said, tubercular and glandular enlargements and indurations, affect both the divisions of these canals at the same time, as well as the pustular inflammations and ulcerations. Therefore, though the alimentary lining coats be more out of reach of the remedial measures above recommended, as direct fumigations to the air pipes, yet as any application, capable of altering the latter, may indirectly benefit the former, we would recommend, along with topical fomentations, baths, and such other medical treatment as may be enjoined, to aid their effects and open the pores, by inhaling warm vapour into the lungs *for a long time*, till perspiration freely breaks out. I am aware, from abundant experience, how ready a certain description of persons will be, to declaim against this remedial measure, as well as every other of the kind. Destitute of comprehension to understand the principles on which the recommendations are here founded, the parties will gladly embrace every opportunity of amusing their associates with mistaken descriptions of what they know nothing; and as already in many instances, they will freely indulge the only faculty nature has bestowed on them, *that of ridicule,* to persuade their patients against a plan which they never saw, and will not apply, or allow those to be called on who would; but, perhaps, when they are well aware that it is too late, then they give their glad consent, and exult when it cannot effect impossibilities. It is a great pity, that any dissertation would require to set forth such remarks; it is a greater, that they are so often imperatively called for.

As was formely said, it is injurious to irritate the tender or inflamed linings of the alimentary canal, by antimonial, or other diaphoretics; therefore, if we cause a patient to perspire freely without medicine, we surely should not be prejudiced against the procedure.

In alluding to the applications of baths and fomentations, as auxiliaries to the treatment of disordered mucous membranes of the primæ viæ, it would be occupying too much space to continue a detail of the several diseases, and their separate symptoms. Because, if judiciously employed at proper periods, *fomentations* will seldom be injurious to any variety of such complaints. The more urgent the inflammation and pain, the greater necessity is manifest for relaxing means, capable of diminishing irritation, eliciting the blood from the interior to the outer parts of the body, and removing the effect on the nerves, which irritation and inflammation invariably produce, when the stomach is affected.

Sir A. Clarke, in his work on bathing, describes a case, in which the long detention of a patient, in a common slipper bath, into which hot steam was directed, through a tube, under blankets, greatly assisted the other active means, by which a very aggravated case of enteritis, or inflammation of the bowels, was cured.

"Fomentations, or embrocations with warm water, (as a judicious writer has remarked) are often very powerful means of abating internal inflammation. This effect is very apparent in some of the deeper-seated inflammations, as in the inflammation of the urinary bladder, intestines, or other viscera contained within the cavity of the abdomen. The warmth, in this case, may be applied to the surface of the abdomen, by bath or fomentation, or, in the way of injection, by the anus, &c. In some inflammations of the joints, warmth also is found to be very useful. These, however, are inflammations which have a tendency to the chronic state" *(See Thomson on Inflammation, p.* 128.*)*

From what was said, near the commencement of these pages, of the effect on the external skin, produced by any substances irritating the villous coat of the intestines, we may reason how much that tunic would be affected by relieving and softening the cutaneous papillæ. But as infinitely more efficient means must be adopted in treating inflammations of the digestive passages, we refer only to the active and efficient use of warm steam or water, as a useful secondary medium of determining the concentration of the complaint from the part affected, and also aiding to induce that deliquium and cessation of over-action, so desirable for diminishing pain, and enabling the medicine to produce its effects.

Gastro-Enteritis,

ACUTE INFLAMMATION OF THE MUCOUS TUNICS OF THE ALIMENTARY CANAL.

Not having detained the reader with relations of particular symptoms, which distinguish the disease here mentioned, either when confined to the stomach, or to portions of the intestines, I shall merely mention a *case*, which may point out the prominent character of the complaint, and the danger of dilatory proceedings, or neglect, at the beginning, before advice is obtained.

Miss C., a very respectable lady, aged sixteen years, after returning home from a ball, where she had danced, felt considerable cold and fatigue. Next evening, having almost unavoidably attended a similar assembly, the effects of the previous night were overcome by the exercise of the body in dancing, and the agreeable occupation of the mind. A journey of ten or twelve miles the second day after, and long exposure to cold, confirmed the complaint, which might have been easily averted or removed at its commencement.

One ball immediately succeeding another, is more injurious than ten at regular intervals; as a man finds a daily slight excess of stimulating drinks, worse than a considerable breach of temperance once a month. The continuation of the excitements do not give time for the recovery or renovation of strength. The first ball produced the languor and debility, or the condition calculated for inflammation. The next, so soon after, and before strength returned, confirmed this disposition. The weakened internal vessels, and the flaccid membranes, presented no elasticity or resistance to the accumulation of the fluids driven to the internal parts, when the pores of the skin were closed up, and the capillaries were lessened by the tedious exposure to cold on the journey.

On arriving at home, this lady felt uncommonly chilly; the lassitude and weakness increased, with wandering pains in the abdomen. She soon began to complain of pain and oppression in the region of the stomach. Nausea supervened, and afterwards repeated fits of vomiting. After a restless night, heat of skin, thirst, anxiety, total loss of appetite, with parched dryness of the throat, were greatly complained of. The bowels being confined, she took some senna with Epsom salts. The day after, as there was no effect produced, Dr. Forcade was called in. Finding the stomach distended and tender, with colicky pains, flatulence, and quick pulse, he very properly abstracted three cups of blood from the arm, ordered very active purgative pills, with calomel; these producing no effect the third day after her arrival, and the tension of abdomen, heat of skin, and quickness of pulse increasing, he drew three cups more from the other arm, ordered a dose of castor oil and purgative enemas; next day, (the fourth,) the symptoms were much aggravated; Dr. Forcade proposed a consultation, and I was called in.

I found this lady sitting half erect in bed, her eyes languid and dull, face pale, except one deep evanescent flash of red on the cheek, constant desire for cold drink, lips and skin peculiarly dry and parched, the arms tossing, and thrown alternately on the bed, as if troublesome and heavy; the tongue deep brown, red at the tip and sides, white in the middle, and rough, with sharp erect papillæ. There seems a reluctance to answer questions, and the words are uttered as if the tongue were hard. The pulse is small, contracted, and very frequent, (140 in a minute), the epigastrium greatly swollen, and the arch of the colon distended with flatus. The pain, on pressure, is not so acute as the violence of the other symptoms would lead one to expect. There is considerable tympanitic resonance, on percussion of the hand laid over the swelling.

Three dozen of leeches were now applied on the prominent part of the abdomen, where most tender and sensible to pressure, one ounce Ol. ricini, and half an ounce Ol. tereb. were administered; on the leeches falling off, she entered a warm bath, and remained half-an hour, her head being raised on pillows in the bath. In three hours the castor oil and turpentine were repeated, and several large enemas were used. Early next morning, she was worse, no evacuation, epigastrium tender, skin hot and dry, countenance indicating suffering, though no complaints are expressed; listlessness seems more apparent than pain; there is reluctance to speak, and inability to move.

Three drops croton oil were now given, and washed down with gruel, to remove the acrid sensation. The epigastrium being still tense, though less prominent, as cloths wrung out of hot water are troublesome to foment with, and are variable in the heat they communicate, I determined to admit warm vapour to ply on the part affected, from the pipe of the boiler, (see plate.) The bed being distant from the fire, two pieces of tin tube, kept for such purposes, were attached to that of the vessel, and supported on a table, where it reached the bed. The steam was admitted from the orifice near the part affected, a cloth being interposed to prevent the too direct application of the heat. The vapour was gradually approximated so warm, as scarcely to be supportable by the hand of an attendant; yet it is very remarkable, that the patient was not sensible of the high temperature, for a long time, on the parts affected.

In an hour or two, however, the obstinate want of sensibility to heat seemed to be overcome, and the swelling became easily affected, by a more close application of steam.

The thick cloud of vapour rising through the blankets, diffused itself about her face, and was inspired in the breath; the extremities became softer and warmer. There was an evident relief expressed in the aspect. After three hours, on Dr. Forcade's arrival, three drops more of the croton oil were given. He was so pleased by the relaxation and ease contributed by this permanent method of fomentation, that he kindly offered to remain and attend to its progress for some hours.

When the patient was immersed *eight hours* in this sea of vapour, and in a bed saturated with hot moisture, the purgative medicine began to act; a warm bath being got ready, that she might remain in it until dry bedding could be substituted. In this she lay horizontally during an hour, became lively, and was laid in bed free of pain; swelling very much subsided, skin soft, and countenance tranquil and composed.

The medicines afterwards continued to act in the ordinary doses, and the prominent features of this complaint disappeared.

DYSENTERY and DIARRHŒA,* particularly in their first or inflammatory stages, will also derive material advantages from warm topical dilution, and relaxing applications of heat. Dr. Bradsley, in his medical reports, testifies the importance of heat, applied through the medium of steam. Dr. Kentish describes a case of *diarrhœa*, of long continuance, which had resisted all the known means of relief; and also a case of *chronic catarrh;* both restored to perfect health by the use of the vapour bath. The brown or reddish pustules which are occasioned by inflammation of the mucous follicles, and the red dots and ulcerations cause such pains, contractions, and spasms, as to justify the incessant application of the vapour to the abdomen, during several hours daily, both to diminish pain, relax irregular constrictions, and conduce towards a condition more capable of being re-

* That in diarrhœa there is extensive superficial inflammation of the villous tunics, is confirmed by the testimony of Glisson, Baglivi, Morgagni, Pinel, Baillie, Petit, and Abercrombie.

lieved by medicinal treatment. In a disease partaking so largely of febrile character, the importance of deter mining the skin to softness, and transpiration, is obvious to all.

Cholera.

In this disease there is such sudden and untoward irritation of the mucous villi of the bowels, that the nervous system is disturbed. There is spasm, with violent pain of the stomach, cramps of the limbs, contraction of the countenance, with the aspect of deep and distressing anguish.

Spasmodic Colic.

Though this cannot be called a disease of the mucous membranes of the bowels, yet it generally arises from irritations of them, such as indigestible matter, or flatulent vegetables taken into the stomach, or from standing long on cold damp ground. As both these complaints bear pressure on the abdomen, and indeed are relieved by it, there is a well marked distinction from inflammations of these parts. The nervous irritations and constrictions in both, will be certainly relaxed and alleviated by constant application of the vapour, in the manner mentioned in the case, page 275.

Colica Pictonum.

The prevention of painters' colic was alluded to, page 146. From the powers exerted over lead by sulphur, the vapour bath of that medicine may be preferable even as a cure, or alternated with the warm water bath, and the continued use of oily aperients.

Intus-susceptio.

For similar reasons to those mentioned under spasmodic colic, the constriction and reaction of the containing and contained portions of bowels may be lessened, and time gained to establish relaxation and freedom of the obstruction. If impossible to obtain this desirable result, then the part affected should certainly be laid bare, drawing in a covering of hot oil, with the first and every other incision, and on exposing the instus-sucepted part of the intestine, mechanically relieving the strangulation. Like bronchotomy in croup, the operation should be performed early. It is in delay the danger is, more than in the attempt to remove it.

Hæmorrhoids,—Piles.

THOUGH these tumors generally arise from the dense cellular tissue which connects the sub-mucous to the muscular coat; yet as the application, mentioned page 22, is very beneficial to any tubercular or other concretions, on or under the mucous coverings, I wish again to recommend it here.

IN treating of the influence of *dilution* and *temperature* on the gastro-enteric mucous coats, we may mention generally, that the value of distending the stomach and bowels with large quantities of warm liquid, is not sufficiently appreciated. In those multiform symptoms attending chronic and long continued inflammatory alterations in the texture, consistence, or functions of the villous tunics, in cases of colic tormina, caused by acrid or green vegetables, fermented liquors, or cold drinks, when the body is heated, the copious potation of hot water is, in several ways, beneficial. The hot water dilutes and washes away irritating matters in the primæ viæ, relaxes the twisted fibres in the muscular tissues of the intestines, operates as an efficient diaphoretic in opening the cutaneous pores, and balancing the external and internal circulations; and finally, it mechanically removes the spasms and contractions of the bowels by the distension and dilatation occasioned by copious quantities of warm drink, filling up the cavities of the canals.

When the complaints extend to the colon and lower viscera, large, warm, soothing enemata serve similar purposes, when freely introduced, removing cramps and rigidity, and fulfilling several purposes of fomentation, and extension of relief, even to neighbouring cavities.

There are many other minor degrees of disease in the villous tunic and follicles of this important canal, to which the general principles, above so imperfectly detailed, will not unfrequently apply.

In congestions of the viscera, fumigations have been lately much recommended. The chlorine vapour has been highly extolled, particularly where the liver is affected; the impetus of the blood flowing to the surface, is supposed to overcome various obstructions of the internal organs. Since these pages were written, I learn that chlorine vapour has been lately used in France, in consumption.

INFLAMMATORY AFFECTIONS OF THE GENITO-URINARY MUCOUS TUNICS.

THE unexpected length of this essay, and the general adaptation of bathing and fomentations, to various affections of the urinary and uterine cavities and passages, will preclude tedious definitions and distinctions of the complaints of organs situated in the pelvis, or diseases of their outlets.

The indirect influence oft emperature and moisture, on the simple solids, connected with important functions of these parts, we have separated, as an appendix for the readers of that department of physiology.

The canal called urethra, is liable, like other mucous pipes, to at least three degrees of inflammation. The first begins with *heat and burning*, when the urine passes along it. The second shews *albuminous secretion*, and the third, particularly if owing to contagion, speedily exhibits *purulent* discharges. That this pus is not itself a secretion, as is generally said, but the product of one, may be inferred from this, that the purulent discharge, when perfected on the surface, will produce a disease *sui generis*, which the albuminous secretion will not do, and which cannot be generated from pus, in other parts of the body, exactly similar in atomic composition, unless by infection. As the elucidation of these topics would occupy too much space, we must proceed to the practical application of which we are discussing. I am not aware, that, during the first stages of these complaints, warm applications have been enough recommended. Before the suppurative stage, sitting a few hours at night in a hip bath, at 98°, and, occasionally, during that time, filling the passage, per injectionem, with the warm water, has produced a softness and reduction of excitement, which caused the disease to pass away, in two or three days, without swelling, tension, pain, or constitutional disturbance.

Again, where this was not soon enough employed, and there was such urethral inflammation, as to thicken the sub-mucous membrane, diminishing the calibre of the canal, and causing difficulty, or nearly suppression of voiding the urine, then a similar bath, with eight or ten leeches along the membraneous portion of the part, resolved the disordered state of the passage in a very short time. After the irritability was subdued, throwing up one or other of the medicated oils, mentioned at the commencement of this essay, soothed the lacunæ, prevented the extension of the inflammation, or continuous irritation to the vesical coats, lubricated the interior surface, hindering ardor urinæ enlargements of Cowper's glands, and those spasmodic excitements causing chordée.

The above measures may fairly enough be denominated preventive, as they guard against many serious consequences, particularly the mal-practice of sharp lotions. But the repeated and continued use of fomentations, and local or hip-baths, is very beneficial, where, from bad treatment or neglect, not only the membranes in question, but even that of the bladder, thicken and indurate, or discharge mucous purulent fluids. There is here a valuable advantage in the early use of leeches and warm bathing, in guarding against the effusion of lymph into the sub-mucous tissue around the lining of the pipe; for when this lymph solidifies into fibrinous layers between the coats, it pushes in the interior one, lessening the canal, and inducing that contraction called stricture. In like manner it prevents the swelling and indurations of neighbouring parts. If temperance, repose, and antiphlogistic regimen be carefully attended to, present symptoms will be mitigated and removed, and probably more violent and permanent consequences prevented.

Cystidia,

INFLAMMATION OF THE BLADDER.

THIS is also called Cystirrhœa; but the latter is only a degree of the disease. The spreading inflammation commonly begins near the neck of the bladder, causing copious discharges, extends along the mucous lining, and in violent cases involves the tunics exterior to it. When it becomes chronic, there is thickness, and sometimes contractions of all the coats,

So far as the department of the treatment embraced in this treatise is concerned, the mode of bathing, and directing a long continued topical stream of vapour on the region of the part affected, are essential auxiliaries both for cure and comfort.

In bad or long continued cases, and where the inner tunic is ulcerated in spots, daily injection of bland oil, with or without some sedative impregnation, such as the Olea Cocta, of agreeable strength, should be the chief means adopted. The heat, and soothing influence of the anodyne oils, give unspeakable ease, and save the constitution from sinking under irritability and distress.

The decoction of *buchu leaves*, and *uva ursi*, recommended before, is very valuable in these affections, as well as the analogous diseases of the mucous linings of the trachea and bowels.

For those suffering from the excruciating tortures of stone, and the rough attrition on the sensitive and excited fibres of the bladder, sitting in the hot hip-bath will divert the pain ; and filling the *vesica* with some of the medicated oils, will hinder the rough friction of concretions, the contraction of the bladder, and the dreadful distress occasioned by the contact of a hard or gritty calculus on the denuded mucous membranes of that organ.

The persevering application of long continued relaxing baths and fomentations, though they could not absolutely resolve or heal, yet might soften and relieve, the hard, thick, or granular state of the mucous coats, described by Hoffman, Portal, and Morgagni. Great thickening of the mucous tunics of the bladder, and vascularity of their surfaces, are diseases often met with, and are said to have occasioned the dissolution of many great men, as of Voltaire, Buffon, D'Alembert, and Spallanzani.

The remarks here adduced, will apply in a great measure to uterine affections of the mucous membranes. In all ages and nations, the importance of fomentations and diluents, were appreciated, in female affections of these organs: long continued perseverance in their use, under proper regulations, when judiciously employed, will always continue to aid the treatment which the physician or the obstetric professor may recommend.

CAP. XVI.

CLASS III.

Serosæ,

INFLAMMATION OF THE SEROUS TISSUE.

THOUGH the influence of *heat* and *moisture*, is but indirect on internal parts, yet as general beneficial consequences are derivable from their agencies, we will glance at a few prominent differences in the structure, functions and disorders of the SEROUS tissues, though not tangible by baths or vapours, through any direct exterior communication.

The cutaneous, and mucous membranes, seem made up of chorion; the serous of myriads of minute and finest filaments; a tela of delicate fibres and invisible vessels.

The skin and mucous coats, tough and pulpy, bear the same relation of structure to *serous tissues*, that the thick and artless Felt presents in its fabric, when compared to the thinnest web of well woven silk. The mucous surfaces have outlets communicating in some part with the air; but the serous membranes are shut sacs, doubled on themselves; their contents placed in this inflected lining, so as, properly speaking, to be outside, and to resemble a double night-cap enclosing the head; but the mouth of this duplicate covering being shut, so as to present neither entrance nor outlet. At page 91, it was observed, that these cavities, or the inner serous surfaces, are constantly receiving *vapour* in health, and giving out *water* in proportion: during this process the tunics are glistening and translucent. But when inflammation attacks them, their transparency becomes dull; they are no longer diaphanous. The vessels fill up, and in a short time the substance and surface of the membranes are studded with arborescent or radiated red ramifications; in other cases, with a net-work plexus of injected capillaries.

This stage of SEROUS INFLAMMATIONS, which may be taken as the first, we will venture, for the sake of practical induction, to place in this class, as a subdivision, or order, under the title

VASCULOSÆ.

Although this term would apply to the inflammatory injected state of the vessels in other tissues, yet so would the outlines of the treatment. It is during this stage, which is said to last, in large extended sacs, such as the pleura and peritonæum, from six to twenty hours, that the greatest chance of useful results are to be expected from the reduction of this vascularity, and the restoration of a balance of power among the different internal and external dominions. Bleeding, though it deprives every part of a little, yet takes most from that which is too full, merely by enabling neighbouring regions to abstract from that which has too much. It also dilutes the over-fibrinous condition of the blood, by disposing the veins to replenish themselves by watery inhalation. Diaphoresis diffuses an equality from the inner to the outer surfaces. Warm bathing will greatly accelerate that desideratum. But where the constitutional disorder runs high, care must be taken to guard against elevating the temperature, so as to hurry the circulation.

SECOND STAGE.

A continuation, or probably a consequence of the *vascular* or plethoric stage, is *effusion* of clear fluid from the red points of the membranes. This liquid, which, if simply albuminous and aqueous, would remain so, as we find it in serum, undergoes atomic changes, when secreted, and *out of the circulation.* This mutation of elements is modified by the injected, diseased, or altered state of the tunics; and again, like cause and effect, by the increase of temperature, which the new combinations when evolving, can produce. From all the observations I could make, there is more of *gelatine* than albumen in the first exudation into these *inflamed* cavities. The altered condition now going on, disposes the oxygen and hydrogen of part of this gelatine, to combine in the proportions to form water; this is either absorbed, or in certain states accumulates, causing another stage of these inflammations called dropsies, which, as continuations of the complaints, may very simply be entitled

AQUOSÆ.

Where the constitutional, or other causes, do not predominate in producing asthenic changes, and water does not form in such quantities as to fill the sacs; but where sthenic and fibrinous formations are readily evolved, then the azote of that portion of gelatine which had formed water, being now liberated, joins another portion of the gelatine, and constitutes *fibrine*; during this last and preceding conversion, there is heat and febrile action, and the resulting product of the inflammation confers the name on these inflammatory affections: hence they are denominated

FIBRINOSÆ.

This term should convey more *meaning* than Mr. Hunter's "adhesive inflammation."

As the *mucous* membranes, when inflamed, throw out *albuminous* matter in the second stage, so the *serous* when excited, disharge gelatine, or it is found immediately after the effusion. This is called, by authors, albuminous fluid, but it is more animalized than that principle, and the part of it which advanced from albumen to gelatine, and thence to fibrine, and turns fleshy, forms those depositions containing red vessels, and constituting adhesive and adventitious membranes. It is this fibrine, when organized, that adds to the bulk and thickness of the tissues, and unites their opposite surfaces as a new medium and matrix for vessels passing from one coat to the other. If this result do not follow, the chemical interchange of atoms again varies. The fluid is altered, in part, by a new disposal of some of its elements, each separate mollecule being converted into one of *pus.* May I, therefore, venture to assert, *that this* PUS *is not a secretion, but an alteration of one?* If this view be rational, we might recapitulate that the liquor injected into an inflamed sac, instead of being lymph and healthy albumen, is a mixture of these with gelatine; that some of their atoms, influenced by diseased condition and debility, form water, and some advance to fibrine and other animal principles; these again passing into *pus,* by the higher degree of heat, and the progress of the disorders. During this last atomic combination the heat becomes latent, and the sensation of coldness succeeds.

This mutation of the elements following inflammations in the class *serosæ;* where pure globular pus is collected in quantities, in sacs, we beg leave to designate

PUROSÆ.

For the sake of being distingushed from the oozing purulent discharge of mucous cavities.

Since the days of Mr. Hunter, and long before, we were taught that the inflamed arteries assume a new action, occasioned by disease, and discharge *albumen;* that this *thickens* and forms coagulable lymph; further, that these same arteries change their operations, and in place of choosing to pour out ready made albumen from the blood, they manufacture globules of *perfect pus*, which they emit into the cavity, or deposit, as bees do honey in their cells.

We admit that fibrinous matter, called coagulable lymph, may be formed from albumen, but not by coagulation; for the albumen in healthy serum, or even in that from blisters or burns, will not coagulate without heat, amounting to several degrees more than the hottest inflammation can reach: what was supposed coagulated lymph is consolidated by atomic changes, as regular as those which form muscle or bone, and in all its other characters it differs from solid albumen.

When it breaks down into suppurations in the cavities, it is not surprising that Hunter, Bailie, and before their day, Simpson, de Haén, and Morgan found suppurated matter in serous sacs, without ulceration or breach of structure. Dr. Black, an eminent physician of Newry, found two quarts of purulent fluid in the cavity of the peritonœum,* and like the other celebrated men, already mentioned, and many more that I could name, wondered how it got there.

They were not aware that it became pus *after* its entry into the cavity, and not as Simpson first insisted, and Mr. Hunter afterwards maintained, that it was *secreted* from the blood by some power of the arteries, as milk is from the mammæ, and bile by the liver. In order to carry on this new glandular office of the arteries into close sacs, it was necessary that collections of pus, in every other place, should have a sac, otherwise the *secretion* could not so philosophically go on, for I suppose they did not

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* Clinical and Pathological Reports, &c. Newry, 1819.

endow a certain length of the arteries with the pus-making power, but merely their minute mouths, which were said to open into the sac, but which mouths no microscope can make visible. This is the way that the safety lamp acts. Its principle is a certain property belonging to *tubes,* but sections of these tubes serve the purpose, so that a net-work of their mouths is perfectly sufficient.

It is easy to find objections, but there is not always such facility in furnishing better or more rational reasons for many phenomena.* I would venture to doubt that the pus was made in abscesses, by the new formed sac, or rather secretion, from its arteries. I would be more inclined to suppose, that the pus condensed the sac, than that the sac generated the pus. The outside of a tumor is the last turning into matter. That process commences in the centre, and as more and more forms, it pushes back the membranous fibrine, not yet broken down into pus, and at length consolidates it into a coat at the circumference, whether capable or not of the function of *secretion,* abundantly permeable to percolation. The older doctrine, that the solids were dissolved into pus, is still more untenable, though Mr. Hunter seems to favour it;† for we find pus formed without the loss of any solids. The opinions that purulent matter was evolved by fermentation, or from extravasated blood, or that it possessed of itself corroding or solvent properties, were still more groundless.

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* Si quid novisti rectius istis.
Candidus imparte, si non, his utere mecum.

† The proportion which the white globules bear to the other parts of pus, depends on the health of the parts producing the discharge. When the globules are very abundant, the matter is thicker and whiter, and is called healthy pus; the meaning of which is, that the solids *which produced it,* are in good health; for, these appearances in the matter are no more than the result of certain salutary processes going on in the solids, the effect of which processes is to produce the disposition, on which both suppuration and granulation depend.—*Hunter.*

The prevalent opinion may be right in so far as it attributes new or altered action to the arteries; but this does not cause them to discharge pus from the blood, but a secretion of fluid is determined to the part, whether a *serous sac*, or *inflamed tumor*,—this liquor, altered by other agencies, going on at the time, such as absorption of its thinner parts, and atomic changes of the remainder, is disposed to a condition calculated to convert that altered liquor into pus, if not concluding in a more sthenic termination of living fibrine, forming new structures, or additions to the old.

We do not see pure pus on an exposed surface, either of skin or mucous membrane, at the instant of secretion. The arteries are abundantly excited by a burn or a blister; but the blood near the part is still the same, and the vessels do not throw out pus at once, but they throw out *what makes it*, so soon as the conversion has time to take place.*

When the pores are obstructed in febrile or other attacks, if there be an ulcer, it will become dry, and pus will cease to cover it, because there is no lymph, or other liquors, thrown out to be converted into that matter; but if pus were driven out at once from the arteries, as the modern doctrine maintains, ready formed from the blood, its quantity would be increased in febrile heats, because the vessels are then more active.

Where there is not a disposition to produce good pus on the surface of a sore, there is not a condition to generate healthy granulations. But this is not the *effect* of the bad suppurated matter, it is the effect of whatever cause makes it bad, or hinders the discharged liquor from advancing first to gelatine, then to fibrine, and of course

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* Sir E. Home seems to support this idea.

prevents a part of it from forming granulations, and a part from being turned into pus. If this be true, that the flesh which fills up a hollow ulcer, and the globules of matter which cover it, during its growth, are both composed *in that ulcer*, and both from the very same liquid, then it is no wonder that if the one process be interrupted, so is the other also.

This topic would require much more explanation than our limits allow. It is mentioned in connexion with our subject, *heat and moisture*, which exert such essential influence in the conversion of animal fluids into suppurated matter.

THE importance of observing stedfast attention to the distinctions between affections of the *mucous*, and those of the *serous* tissues, is greater in a medical point of view, than most practitioners suppose. Wherever the mucous membranes are affected with inflammatory action, there is a feeling of *local* heat, approaching to scalding, if the lacunæ or mucous glands be discharging unusual quantities. The pulse is rather depressed than distended, though it will be quicker, when the constitution feels the lesion ; whereas, in complaints of the serous webs, there is little *topical* præternatural heat; but there is *severe acute pain*, sharply excited by stretching or moving the region affected, and in abdominal cases, the muscles do not start up and resist the hand, when pressing the parietes, as they do in disorders of the mucous linings of the alimentary canals. In serous inflammations there is, moreover, a large wide artery, bounding and striking the finger with a reverberation, as if the under part of the vessel turned up to give resistance when you feel the pulse. Also, (when the disease is violent,) you are justified in bleeding your patient to a much greater and more sudden extent, than can generally be done in mucous disorders. In serous inflammations there is a tension of fibre, as was mentioned before, which imparts elasticity to the vascular and fibrous tissues throughout, whereas similar complaints of the pulpy mucous *felt*, or its fleecy surface, creeps along, sometimes committing considerable damage before the system suffers, and when it does; there is not that tension and firmness which the other tissue presents.

The *mucous* complaints, disorder the machine, as slack or loose chords mar the music of the violin; the serous and fibrous inflammation affects it, as over tension of the wires hurts the harmony of the harp.

To describe the different diseases of the *serous* membranes, with their symptoms and treatment, would be productive of *serious* delay. We must, therefore, postpone, to another occasion, the consideration of this extensive class. The young medical reader will admit the propriety of this determination, when we merely enumerate some of the principal disorders of these tissues, whence it will appear, that the *orders, genera*, and species of the *serosæ* would fill another large volume. Without including the chronic forms, we will merely enumerate a few of the acute inflammations of this class.

The first individual serous disease, in point of frequency and importance, is

PLEURITIS, OR PLEURISY,

Of which we will say a few words, in connexion with the subject of consumption, of which this affection is often the cause, or, indeed, more properly speaking, the first stage. This occurs when the inflammation extends to the contained parts of the pleura, and disorganization takes place.

In the first, or *vasculose* state of this disease, a pain of a very acute kind occurs in some part of the chest, after a cold or rigors; there is felt a sharp uneasiness under the ribs, the patient speaks and coughs, as if he wished to avoid moving the place affected. If the complaint extend to both sides, the respiration is quick and small, as little air can be taken in at a time, owing to the immobility of the ribs. When the patient sneezes he supports the parietes of the chest with his hands, and covers the pained space to prevent its being agitated or disturbed. It is during inspiration that the pain is most acute, because the inflamed membrane is then upon the stretch, and it is then, also, that the breathing is hurried and short. If he sigh, he is cut, as he expresses it, across the chest, and cannot take in the full inspiration constituting a sigh. Percussion gives some pain, but obtuse, and the respiratory murmur is not obstructed, though it may be weaker; there is smart pulse, fever, and the vibrating, tense artery of serous inflammation.

In the stage of effusion, there is great weight and compression of the side affected, with difficult breathing, and there is a dull sound returned on percussion of the thorax, at the lowest part, when the patient reclines; as the fluid accumulates, the sound becomes duller, and the stethoscope indicates, that the respiratory murmur has nearly ceased in that side and increased in the other, where no fluid has collected.

The pleura covering the diaphragm, when inflamed,* is productive of very distressing symptoms, an intense pain along the margin of the false ribs, extending often to the loins; the countenance is extremely anxious and distressed; orthopnæa, vomiting, cough, and hiccough; the patient stoops forward, draws up the knees, and the diaphragm is completely immoveable on inspiration.

During the first stage, the lancet, blisters, profuse antimonials, and saline aperients, must be so strenuously

* Observations sur l' inflammation de pleuri diaphragmatique.—*par Andral.*

employed, that we have scarcely time to attend to minor auxiliaries, such as the application of vapour. It is very injurious to toss or disturb a patient in acute and dangerous pleurisy; therefore, we must be cautious in bathing, and any other procedure requiring exertion or effort. In all inflammations of this kind, there is, during the first stage, the same dryness of skin that there is in the inflamed membrane, and it is probable that the admission of steam under the blankets, when the patient lies quiet in bed, might tend greatly to relax the surface; and if there be acute rheumatism of the intercostal muscles, it soon removes it. Again, we must observe, that experience will be required to determine the value of this mode of fomentation in pleurisy, and the degree of warmth justifiable to be used.

Whilst the inflammation runs very high, I am of opinion the steam should be admitted at such a distance as to soften and soothe, but not to heat or excite. In fact, vapour can be managed in the manner before stated, so as to reach the body so cooled, and distant from the pipe, as to abstract heat, or at least give the feeling of agreeable coldness to the skin. I have not had sufficient opportunities to speak of *soothing tepid inhalations* in this complaint, in a manner to warrant my offering decided opinions of them.

" A free expectoration being the mean which nature usually adopts to relieve herself of this inflammation, it ought, therefore, to be encouraged by every possible method, such as inhaling the steams arising from warm water and milk, or from a decoction of emollient herbs."*

Cold has been recommended by some, but I think it would be likely to injure, as it retards perspiration.

Bartholine, who wrote a latin work on the *medical use of snow*, differs far from the recommendation of the

* Thomas.

temperature held out in this essay. He affirms that snow preserves from the plague, cures fevers, colics, headachs, diseases of the teeth, sore eyes, and pleurisies, for which use, he says, his countrywomen of Denmark, keep snow water, gathered in March.*

SUBDIVISIONS OF THE CLASS SEROSÆ.

Vasculosæ.

RESERVING the further observations of the serous inflammations to another opportunity, we will here merely mention the following disorders of these delicate envelopes :—

Acute inflammation of the

PERICARDIUM, PERICARDITIS.

This disease of the sac, which encloses the heart, is very fatal, but fortunately rare.

PERITONITIS, or inflammation of the large membrane covering the bowels. This disease, both in the common form and that affecting females after parturition, called *puerperal fever*, is amenable to local applications of vapour. This mode of conveying and continuing efficient fomentations, will be found particularly advantageous in conjunction with such other practical means as may be requisite; the best of which, after free depletion, will be the copious internal use of oil of turpentine, as first pointed out by Dr. Brenan.

Inflammation of the various coverings contributed to the viscera by the peritonæum, range themselves in species, according to the organs they invest.

ARACHNITIS, or the inflammation of the delicate membrane lining the cavities of the brain, and covering that organ, is a source of acute and chronic diseases, particularly fatal to the young and delicate.

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* Bartholine, de usu medico nivis.

Aquosae.

WHEN, as was said before, water accumulates in the cavities, and there is not energy, or a condition suitable to cause its absorption, or to convert the albumen which it contains into other principles, then an extensive denomination of dropsical diseases affords series of subdivisions under the class we are now considering. These collections of lymph, are designated from the cavity or sac they fill. When in the *pleura*, it is styled HYDROTHORAX, *dropsy of the chest*; *pericardium*, HYDROCARDIA; in the *peritonœum*, ASCITES; in the .cerebral membranes, HYDROCEPHALUS, &c. &c.

These are distressing diseases, of some of which the drunkards generally die.

————"Aut cum siccatæ febre medullæ
Atque *avidæ fauces gelidum traxere liquorem*,
Tum Lympha intercus vitio gliscente tumescit,
Secernens miseram proprio de viscere pellem."

Purosæ.

The enumeration and treatment of these terminations of serous inflammations, require surgical, as well as medical observations on each. My manuscript, on this division, is so large, that I must postpone it, for the reasons above assigned.

The more healthy terminations of the

FIBRINOSÆ,

Ending in adhesions, are also a fertile subject for investigation, both to the physician and surgeon. When there is adhesion of the costal pleura to the pulmonary, or of the tunics of the viscera to the neighbouring ones, the cases are perplexing and obstinate. Again, after burns, scalds, &c. though not connected with *serous membranes*, yet we may mention here, that, in consequence of neglect, when burned surfaces remain in contact, new vessels shoot across the fibrinous jelly, thrown out by the filamentous or other tissues. When it is organized, the parts so mediately combined, grow together, and often require the knife to separate them.*

Other mechanical means are also essentially unavoidable in certain cases of strictures and diminution of cavities, accruing from the organization of fibrinous formations. Though they proceed from the sub-mucous, fibrous, or filamentous tissues, yet being occasioned by the consolidations above alluded to, we glance at them here, deferring their further discussion to its proper place.

There are various other affections of the serous tissues, which we must now pass over. It is, however, curious that spots, similar to those observed on the skin in cases of hæmorrhagic petechiæ, are often found, on dissection, to exhibit themselves over all the serous membranes. In such instances, even the pericardium has been found distinctly studded with similar petechiæ.

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* Ulceration of the cheek and forehead has sometimes covered the eye with a mass of organic flesh, and the secretions passed off by the lachrymal duct, the following curious case I published, with many others of such adhesions, in 1817:—

A fine little child of Hatton, a weaver, then living at the Gooseberry-corner, suffered most curiously and severely from the effects of burning—she fell against the grate, was unable to rise—the eye-brow, fore-head, and cheek were swelled and ulcerated, the eye supposed destroyed and sunk, was visible no more; the brow and cheek grew together, into one smooth, uniform surface of flesh and skin; there was no trace of the eye, nor even a hollow where the eye had been. Fourteen months afterwards, when I accidentally saw her, she seemed to have been born only with one eye. On finding the cause, I explained to her father, that the eye-ball was so much in motion, so covered with liquid, and so well defended, that it was most probable it had not adhered to the flesh above it, that it was yet safe in the socket, and that an operation would ascertain the fact. After a month, he consented. I cut down over it, fibre after fibre, dividing an incredible depth of flesh; I reached, at length, the beautiful little blue eye; deep and weak, and buried, it glimmered by the stimulus of light, like that of a new-born infant; I prevented the re-adhesion of the separated surfaces, by proper dressings

The fine little girl is now as well as ever, and fully enjoys the benefit and beauty of that eye, which, for fifteen months, had been deeply hidden from the light, unseeing and unseen!—*Newry Magazine, January*, 1817.

CLASS IV.

Parenchymatosæ,

INFLAMMATION OF THE PARENCHYMATOUS TISSUE.

FROM the result of many experiments and observations which I have made, but which are now too tedious to detail in this place, I can find no ultimate or specific difference or distinctions between the parenchymatous material of the brain, and that matrix which surrounds the cellular tissue enveloping the vessels in glands, lungs, ganglions, spinal marrow, nervous pulp, and middle coats of arteries. This matter is *elastic*,* *devoid of feeling (per se), contains little or no fibrine, appears in its minute structure to be composed of a congeries of smallest globules, differently arranged and compacted in texture in different parts, is impervious to tests and reagents*, and from numerous alterations effected on its qualities and organization by fevers, it would seem to be the principal seat of those maladies.

At all events, there are sufficient common properties peculiar to this pith, or matrix, throughout all the parts mentioned, to entitle the *parenchymatous* tissue to be supposed the seat of a CLASS of diseases, the *order*, *genera*, and *species* of which may be ranged from their nature, structure, and the injured functions of the several organs whose pulpy substance is engaged in the state of lesion.

The only complaint of the class PARENCHYMATOSÆ, for which we can find room at present, is PNEUMONIA,

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* We have postponed a long chapter, which endeavours to show, that this property of contraction after dilitation, as well in the tunic of the artery, as in the pith around it, in the brain and pulpy viscera, aids the circulation in the vessels.

or that *inflammation of the lungs* said to be confined to their substance, outside the cellular membranes of the air pipes and blood vessels, and which forms the pith in which they are embedded. I say a few words of the disease in this place, because it frequently excites the growth, or at least the progress of tubercles, and otherwise produces terminations called *consumptions,* some of them very rapid in their course, particularly the kinds formerly called apostematous, where suppurations form, and cavities fill with matter.

The lungs, like the brain, liver, kidnies, and other glands, have a certain relative space, bulk, or extension ; the vessels are surrounded by a certain pulp, medulla, parenchyma, or peculiar pith, which seems a kind of matrix, in which the frame work of the vascular and other systems proper to each mass, may have room, defined limits, and extension.

This very curious corky material, which is, no doubt, modified by its situation, and the functions of the organ it principally composes, is held to be liable to inflammation. That of the substance of the lungs, runs through stages similar to the following.

Pneumonia.

After a severe journey in rain, a young, florid man, on retiring to rest, finds his bed damp, and he remains cold the entire night. In a day or two, he feels a sensation as if his chest were too narrow for its contents; there is a short repeated cough, as if pushing out the expiration ; breathing becomes difficult, quick, and laborious; there is not much pain, unless the pleura be also affected; for, as was already stated, the parenchymatous substance of the lungs is not endowed with sensation. When both sides are affected, the breathing elevates and depresses the abdomen; for the ribs over the affected part remain unmoved. As there is a considerable increase of density, and an infiltration of serous red lymph, the part affected, of course, returns but a dull resonance on percussion. With the stethoscope the respiration is found feeble, and scarcely perceptible in the diseased part, and there is what is called the "*rale crepitant;*" whilst in the unaffected portions of the lung, the respiration is more distinct than natural, or what is denominated "*puerile,*" as if the sound parts endeavoured to make up for the deficient or interrupted circulation of air in the space which is inflamed.

SECOND STAGE.

Unless mucous expectoration and resolution are now brought about, the disease advances, the sound is rendered duller, or lost; as no air can now pervade the condensed texture, the respiratory murmur ceases. The respiration is still more difficult, sputa white or transparent, and draw like a rope when shaken out of the vessel, sometimes exhibiting striæ of blood, at others that fluid is diffused through the sputum, so as to colour it red. This expectoration is commonly designated "*keel coloured.*" In this stage of the disease, when the injected congestion of the part affected renders the lung solid, or of liver consistence, (the "hepatization rouge,") the large trunks of some of the bronchial tubes distend with air, so as to give the voice a resounding tone, as if passing through a horn.

THIRD STAGE.

If, unfortunately, the complaint proceed without abatement or resolution, purulent matter begins to be formed, and mixing with the bloody contents of the cells, changes the colour to a greyish tinge, "*hepatization grise,*" as is observed in post mortem examinations. During this third or last stage, debility is extreme, breathing weak and difficult, the face becomes contracted, lips livid, limbs cold, the pus bursts into the bronchiæ, and the patient dies.

> "In vultu color est sine sanguine, lumina mœstis
> Stant immota genis, nihil est in imagine vivi.
> Ipsa quoque interius cum duro lingua palato
> Congelat, et venæ desistunt posse moveri:
> Nec flecti cervix, nec brachia reddere gestus,
> Nec pes ire potest."*

It will be evident that the first stage, and early in the second, are the only periods where any good can be expected from the medical art, and how much soever any auxiliary remedies may aid resolution, it is to abundant and early venesection alone, that the patient will owe recovery. There is a curious feel in the pulse in this disease, and a kind of rebounding resistance. Bleeding should be proceeded in whilst this vibration is tense.

I have been called too late to many patients in pneumonia, and must say, that I saw a great number die for want of enough depletion, but seldom from too much. Purging distresses and exposes to cold, the other additional means come under the province of a systematic writer on the practice of physic.

On the principles already mentioned, the inhalation of tepid vapour may assist the diaphoresis, and tend to accelerate expectoration. If certain vapours can be found to prevent or retard the consolidation of albuminous or coagulable fluids in the cells, their use, if not *exciting* or *stimulating*, might prevent the effusion into the sacs from becoming so consistent as it does, when it absolutely appears as if granular, when examining the lung from the firm substance which fills the little cell at the end of each minute terminating air branch. Whatever, therefore,

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* Ovid 6, Metam. 304.

could retain these contents liquid, until bleeding would have time to subdue the untoward disorder, would surely render this formidable disease more subject to the controul of proper practice.

It is not safe to praise any secondary means, in cases where unbending resolution must direct the professional attendant to rely on nothing but the lancet. At the same time, when the change is effected on the circulation, auxiliary agents are not to be despised or overlooked.

"To assist their effect, as well as to relax the vessels of the lungs, it will be right to recommend the steams arising from a warm infusion of emollient herbs, such as marshmallow, chamomile-flowers, &c., with an addition of vinegar, to be inhaled repeatedly throughout the course of the day. Few auxiliary remedies have proved more efficacious in this disease than the steam of warm water impregnated with vinegar, and copiously inhaled by means of Dr. Mudge's machine."*

Nervosae.

UNDER the class, parenchymatous, will probably be ranged the disorders of the nervous structure, and derangements of their functions. So far as the subject of spasms is concerned, there is no doubt but long *energetic perseverance*, with either simple or medicated vapour, will relax and subdue cramps, convulsions, and tetanic constrictions, both of nerves and muscles, when used at the same time with other eligible methods of treatment.

In like manner, the glandular inflammations will subdivide themselves into such order as

GLANDULOSÆ,

Under the class Parenchymatosæ, for though their vascular condition is affected in disease, yet there is enlarge-

* Thomas, page 165.

ment, thickening, and disorder of their *parenchyme.* It is rational to expect, that when the local vessels are emptied by proper means, the substance of the tumours may be diminished, when they shall be penetrated during many hours by softening vapour, and percolated by iodine in the state of steam. From such vigorous topical treatment, improved as it will be, is it not rational to anticipate the readier resolution of these troublesome and disfiguring swellings, than the common methods of cure would lead us to expect?

This dissertation having, perhaps, advanced too far, compels me to decline proceeding with the subject of the influence of heat and fluidity, in other classes of complaints. If the very imperfect specimen now presented should obtain indulgent reception, or favourable suggestions towards improving our lucubrations, then we may hereafter submit the remaining cases of diseases, and documents respecting their nature and designations. We will, therefore, conclude, by adverting generally to a few remarks connected with the fifth class

Fibrosæ,

Diseases seated chiefly in the FIBROUS tissue, in all its varieties of texture and situation.

Here we may briefly observe, that gout, rheumatism, and various other diseases of the filamentous, muscular, synovial and other membranes, are very much relieved by adaptations of the simple or medicinal vapours, and other applications already mentioned. The cases collected of these affections are too numerous to be adduced at present. Suffice it to say, that, surrounding a joint, or chronic pain, with appropriate vegetable or other fomenting medicines, folded about by any covering, and causing steam to ply on it for many hours, will sometimes be effectual, where no common mode of cure could be expected to succeed.

Shrunk or contracted joints, where the shortness is in the fleshy part of the muscles, and not in their tendons, as is commonly supposed, will yield to decided pertinacious applications of these vapours; when, if otherwise treated, the stiffness would be very tedious, and sometimes incurable. We have already mentioned, that many tumors will give way and be absorbed, if properly and continually penetrated by discutients carried into their substances by warm and permeating vapours. Here it may also be remarked, that in many of those concretions containing carbonate of lime, which form in the mucous coats of the mouth and bronchiæ, and even in various kinds of ossifications, the inhalation of moderately diluted vapour of muriatic acid in water, well deserves fair and impartial trials, as a preventive, and even solvent of such depositions or concretions. From what was said of imbibition, calcareous settlements in joints might benefit by similar applications.

On the contrary, if *rickets* and other complaints depend on the over-proportion of some acid in the system, dissolving and softening the bones, or preventing due deposition of osseous matter, would not the inhalation of weak vapour of ammonia and water, and the use of alkaline baths, be rational and salutary practice? That inhalation of certain vapours will impregnate the system more rapidly and effectually than the exhibition of medicine by the stomach, could be shown in numerous instances. One may suffice:—Three men engaged in making barometers, applied too much heat in some process of sealing up the glass; the globe burst, and the mercury fell out, and being heated, and partly volatilized, it directly salivated the three men dangerously. One of these had repeatedly taken the medicine by the mouth, but could not be brought under its influence before.

Mr. Carmichael, with his usual accuracy, pointed out many distinctions among syphilitic affections, depending, as he affirms, on peculiarities of the specific poison. I have collected many observations appearing to prove, *that these varieties often originate in the different seats of the inflammation, originally produced by the virus; and also, that changes arise from the qualities which I think mercury possesses of being able to remove the complaint from one tissue, but not from another.*

The consideration of the peculiar action or effects of various medicines on the different tissues, separately taken, presents a large field for careful investigation.

If medicines act by altering the proportions of the ultimate elements, of which the diseased parts are composed, that altered condition will be different, according as the texture, constitution, and composition of the parts are varied from each other. This may be the reason why a remedy may remove a disease or specific virus from the skin, yet that it can exert no power, or if any, rather an injurious one over the affection, if it have fixed on the periosteum. Such circumstances may also account for the difficulty which presents itself in the cure of one person, more than we have to contend with in treating another. We notice how the same character of complaint affects certain kinds of tissue in a similar way, wherever situated; the *mucous* membranes in one manner, the *cutaneous* in another. The *serous*, the *fibrous*, and the parenchymatous structure, each having a peculiar character of determinate symptoms belonging to each ailment of these distinct organizations. As their maladies vary, so may their remedies; those adopted for altering the condition of one, exerting a very contrary effect on another.

One set of medicines will stimulate the stomach to violent antiperistaltic motion and vomiting, which could not irritate the tender surface of the lips or eyes; another will pass through the stomach without exciting any sensation or action in it; and, on reaching the intestines, will then stimulate their coats to severe catharsis. Cantharides will run to the tissues of the bladder, as sure as mercury to the salivary glands. Therefore, if each distinct part lives, feels, moves, and has its particular, as well as common being and properties, so will it be affected, altered, injured, or improved by affinities peculiar to itself.

This partly accounts for the circumstance, that two potent agencies cannot be exerted at the same time in one place. The remedy can ultimately effect the greater change, because it can be brought repeatedly to the conflict, and continued till it succeed in producing an altered condition of the tissue incompatible with the existence of the disease.* The influence of *heat* and *humidity* in regulating and facilitating these changes, is unbounded.

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* Duobus doloribus, simul orientibus, vehementior obscurat alterum.—*Hip.*

A Comparative View of the Diet-Tables of the different Hospitals of Great Britain and Ireland.

Hospitals.	ORDINARY DIET. Breakfast.	Days of Week.	ORDINARY DIET. Dinner.	ORDINARY DIET. Supper.	FULL DIET.	LOW DIET. Breakfast.	LOW DIET. Dinner.	LOW DIET. Supper.
NOTTINGHAM.	A pint of milk porridge for the men, and a pint of tea, with half oz. butter, for the women every morning. For the men, 16 oz. of bread, for the women, 14 oz.; for all under twelve years of age, twelve oz. per day.	1, 2 3, 4, 6 5, 7	8 oz. of roasted or stewed meat, and 12 oz. of vegetables, a pint and a half of beer to each man, and a pint to each woman. A pint of rice milk, or 12 oz. of rice or flour pudding, with sauce, and 6 oz. of vegetables. A pint of broth, 4 oz. of boiled meat, and 12oz. vegetables.	A pint of tea, and ½oz. of butter, for the women; one pint of broth or milk porridge, for the men; or 2 oz. of cheese, or 1oz. of butter, when milk cannot conveniently be served out.	Is formed from the ordinary diet, at the discretion of the physicians and surgeons.	The same as ordinary diet, excepting Monday and Friday, when a pint of gruel is substituted.	Sunday, Tuesday, Wednesday, Thursday and Saturday, a pint of rice milk, broth or bread pudding. Monday and Friday, baked rice, or bread puddings with vegetables.	A pint of milk pottage, or 1oz. of cheese, a pint of milk, with 2 pints of [illegible] at discretion, the beer to be of the strength of 11 gallons to the bushel of malt.
LIVERPOOL.	A pint of milk porridge, bread every morning.	1, 2, 7 3 4 5 6	Boiled beef and vegetables. Rice milk and bread. Stewed beef and potatoes. Pease soup and bread. Ale, gruel, and bread.	A pint of broth and bread on Sunday and Thursday. A pint of milk and bread on the other days.	The same as the ordinary diet.	Consists throughout the day of milk porridge, common batter, or rice pudding.		The ale and beer are bought.
NORWICH.	Sunday, Tuesday, Thursday, and Saturday, two oz. of cheese, and one oz. of butter; Monday, Wednesday, and Friday, milk porridge or gruel, bread and beer sufficient for the day, without waste.	1, 3, 5, 7 2, 4, 6	6 oz. of meat, with vegetables. 16 oz. of baked flour pudding, with half oz. butter or rice milk, or pudding.	Broth on Sunday, Tuesday, and Thursday; 1 oz. of butter or 2 oz. of cheese on the other days.	Is formed at discretion.	Is formed at discretion.		The beer is bought,—neither ale nor porter is allowed.
SHEFFIELD.	A pint of milk porridge, or milk or ale, or onion gruel, every morning.	1, 3 2, 5 4, 7 6	Meat and vegetables, from four to eight oz. Broth and pudding. Meat pie. Pudding, with cheese.	2 oz. of cheese, or 2 oz. of butter, on Sundays and Fridays, or breakfast on the other days.	Dinner, 8 oz. of meat every day. Supper, the same as ordinary diet, excepting Sunday and Friday, when 3 oz. of cheese is substituted, or 2 oz. of butter; ale and porter at discretion.	A pint of weak tea or water gruel, with dry toast or biscuit.	Six ounces of batty pudding or panada.	The same as breakfast, strength of the ale, 1 quarter of malt to 96 gals. of ale; of the beer, 1 sack of malt to 76 gals. of beer.
LEEDS.	Every day a pint of milk porridge, bread as much as is wished for, provided there be no waste.	1 2 3 4 5 6 7	8 oz. of beef or mutton, 4 oz. of roots, and 4 oz. of bread. The quantity of beer is regulated according to the age of the patient. One pint of soup, with bread. One pint of broth, 4 oz. roots, and 4 oz. beef or mutton. Bread sufficient, 4 oz. of cheese, 1½ oz. of butter. Mutton pie. Baked pudding. One pint of broth, 4 oz. of beef or mutton, 4 oz. of roots.	A pint of milk pottage every evening excepting Monday and Friday, when 2 oz. of cheese, or 1½ oz. of butter, and half pint of beer is served out.	Is formed at discretion.	The same as the ordinary diet.	Pudding broth, or milk, with bread. No beer is allowed.	The strength of the beer is 32 gals. from every strike of malt; wine, brandy, and bottled porter, are also ordered in unlimited quantities.
NORTHAMPTON.	Milk porridge and broth every morning; 14 oz. of bread daily.	1, 2 3, 5, 6, 7 4	6 oz. of meat, with vegetables, one pint of beer daily. 8 oz. of meat, with vegetables. Boiled rice, or half a calf's foot or feet, of rice, if preferred.	No supper on Sunday, Tuesday, and Thursday; milk porridge on Monday and Friday; 2 oz. of cheese, or one of butter, on Wednesday and Saturday.	Is formed from the ordinary diet.	The same as the ordinary diet each morning.	Sunday and Thursday, 4 oz. of meat, with vegetables; Monday, Tuesday, Friday and Saturday, 2 oz. of meat; Wednesday, boiled rice.	Sunday, Tuesday, and Thursday, no supper; Monday and Friday, milk porridge; Wednesday and Saturday, 2 ounces of cheese, or 1 ounce of butter.
WORCESTER.	Sunday, Tuesday, Wednesday, Friday, and Saturday, a pint of milk porridge; Thursday and Monday, a pint of broth; 18 oz. of bread daily.	1, 3, 5 2, 6 4 7	8 oz. of meat, baked with rice or potatoes. 8 oz. of baked rice pudding. 12 oz. of baked bread or rice pudding. Meat soup, with rice or barley.	A pint of milk porridge daily.	Breakfast the same as the ordinary diet. Dinner, 6 oz. of meat instead of 4oz.; half a pint of beer.	Milk porridge or gruel.	Rice milk, milk porridge, panada, bread, or rice pudding, varied according to circumstances.	The small beer is brewed with 4 bushels of malt to the hogshead; the ale is double the above strength.
BRISTOL.	On Sunday, Tuesday, Thursday, and Saturday, milk porridge; Monday, Wednesday, and Friday, meat broth; 12 oz. of bread on meat days; 14 oz. on the other days.	1, 2, 5 3, 4, 6, 7	½lb. of meat, with vegetables; two pints of beer daily. A pint of gruel or pap.	A wine pint of gruel or meat broth on Sunday; 2 oz. of cheese for the men, ½oz. of butter for the women, on Monday, Wednesday, Friday, and Saturday.	The patients have meat every day.	A wine quart of milk pottage or milk.	A wine quart of weak broth.	The same as breakfast, 24 ounces of bread, and barley water for common drink; 20 bushels of malt, 25lb. of hops, to 14 pots of strong ale; 22 bushels of malt, and 22lb. of hops, to 300 gals. of ale; 11 bushels of malt, 7lb. of hops, to 360 gals. of small beer.
GLOUCESTER.	A pint of milk porridge or rice gruel, with three oz. of bread every morning.	1, 3, 5, 7 2, 6 4	4 oz. of meat, 8 oz. of vegetables, 4 oz. of bread, half a pint of beer, one pint of broth, with two oz. of bread. A pint of rice milk, 4 oz. of bread, one pint of beer. 12 oz. of rice pudding, 4 oz. of bread, one pint of beer.	4 oz. of bread, one pint of beer, 2 ounces of cheese, on Sunday; the same, but without the cheese, on Tuesday, Wednesday, Thursday, and Saturday. 4 oz. of bread and one pint of beer on Monday and Friday.	At discretion.	Milk porridge or rice gruel.	4 oz. of meat, 4 oz. of bread, 4 oz. of vegetables, and ½ pint of beer, excepting Monday and Wednesday, when no bread is allowed.	Same as breakfast; on Wednesday an ounce of cheese is ordered. Ale, 8 bushels of malt, 10lb. of hops, to 60 gals. of small beer.
SALOP.	Milk porridge every morning; 14 oz. of bread daily.	1, 3, 5 2 4 6 7	A pint of broth, 8 oz. of meat, ½lb. of vegetables, one pint of beer. Rice pudding, a pint of beer. A pint of soup or flour meal, with bread; 16 oz. of rice pudding. 8 oz. of boiled meat, ½lb. of vegetables, one pint of beer. One pint of Irish stew, with a proper quantity of bread.	A pint of good broth on Saturday, Tuesday, and Thursday; a pint of milk porridge on Monday; 2 ounces of cheese and half a pint of beer on Wednesday; a pint of milk on Friday, Saturday or Wednesday.	At discretion.	At discretion.		About 7 gals. of ale are brewed from a bushel of malt; small beer from 18 to 20 gals.; cyder and beer are occasionally used with the malt for the latter.
MANCHESTER.	A pint of milk, or drink pottage.	1, 3, 5 2, 4, 6, 7	8oz. of boiled mutton, beef, or veal, with broth, pudding, and roots. 16 oz. rice or flour pudding, with roots.	As the breakfast, with the addition of an ounce of butter, or 2 oz. of cheese occasionally.	At discretion.	At discretion.		
NEWCASTLE Upon Tyne.	Sunday, Tuesday, Friday, and Saturday, from 1 to 1½ pint of milk porridge, or one pint of hasty-pudding with milk; Monday and Wednesday, from 1 to 1½ pint of rice gruel or rice milk.	1, 3 2, 6 4 5 7	One pint of broth, with 8 oz. of boiled meat. Twelve ounces of rice or bread pudding. 8oz. of boiled meat, with 8 oz. flour pudding. 8 oz. of boiled meat, with potatoes or vegetables. 8oz. boiled meat with a pint of broth.	A pint of broth and vegetables, or a pint of milk porridge, or hasty pudding, or gruel.	At discretion.	At discretion.		
BIRMINGHAM.	Milk porridge, with bread cut into it, every morning daily; allowance of bread besides ⅞lb.	Daily	8 oz. of meat with vegetables, and a pint of beer.	A pint of broth every day.	Breakfast and dinner the same as the ordinary diet, ½ a pint of beer, or ½ pint of ale; Supper, ale and 2oz. of cheese, with the addition of ⅞lb. bread.	Tea night and morning, mutton broth, pudding, and barley tea.		20 bushels of malt to the hogshead of ale, 4 bushels of malt to the hogshead of beer.
BIRMINGHAM, Revised 1839.	To each man, 1½ pint of milk pottage, with 4 oz. of bread added to it. To each woman or child, one pint of milk pottage, without bread. To each patient, 2 oz. of bread daily.	1, 3, 5 2 4, 6 7	To each man, 8 oz. of baked or boiled meat; to each woman or child, 6 oz. To each patient, 6 oz. of vegetables and one pint of beer daily. To each man, a quart of rice or barley broth, made with a variety of vegetables; to each woman or child, 1½ pint. 16 ounces of boiled rice or bread pudding. 8oz. of bullocks' baked meat, a pint of rice or barley broth, made with a variety of vegetables. 8 oz. of baked rice or bread pudding, or a pint of rice or barley broth, made with a variety of vegetables.	A pint of broth, milk pottage, or gruel.	Breakfast the same as in ordinary diet. Dinner six oz. boiled or baked meat, six ounces vegetables, six ounces boiled rice or bread pudding. Supper the same as ordinary diet.	The same as ordinary diet.	A pint of broth or rice milk, 6 oz. of baked rice or bread pudding, to each patient every day.	The same as ordinary diet.
EDINBURGH.	One mutchkin of porridge, three gills of milk or beer; or 6⅜oz. of fine bread, milk, or beer.	1, 4 2, 5, 7 3, 6	1 choppin of broth, 3 oz. of butcher's meat boiled in the broth, or beef steak, 5½ ounces of bread. A chopping of broth made of beef and bones, barley, pease, potatoes, and vegetables; 5½ ounces of bread. Potatoe soup, with beef and veal, or bones, bread as above.	As the breakfast each day.	At discretion.	At discretion.		
GLASGOW.	Milk porridge, quantity not limited with half a mutchkin of sweet milk, or one mutchkin of buttermilk or beer.	1 2, 4 3, 6 5 7	Broth made of barley, vegetables, and the dripping of the meat roasted during the week, with a quartern loaf to a man, and half to a woman. Beef boiled—6 ounces to the men, and 6 ounces to the women; a quartern loaf to a man, and half to a woman, or vegetables. Broth, made with beef, barley, and vegetables; a quartern loaf to men, and half to women. Potatoe soup with cow heads, bones, &c. 4 oz. of cheese to men, 4 oz. to women; bread as above.	As the breakfast each day.	At discretion.	At discretion.		
GLASGOW LUNATIC ASYLUM.	Porridge from 7 oz. oatmeal, one wine pint milk.		6 oz. of beef, 2 oz. of barley, 20 oz. of potatoes. Varied as directed.	One-eighth of a loaf of bread, one wine pint milk.	N. B.—In this Asylum, as well as at Edinburgh, inmate lodgers are received for weekly payment, and their dietary, tea, &c. wine, &c. varied.	Is regulated, in some measure, according to their former modes of life and ability to pay, with reference to their state of health.		
DUBLIN HOUSE OF INDUSTRY.	One quart of stirabout, one-third quart of new milk.	1, 2, 3, 4, 5 6, 7	One quart of soup. Three pounds of potatoes. Ditto, and one pint of buttermilk.	Six ounces brown bread, with half a pint of beer, or a quart of gruel.				
FIVE HOSPITALS OF HOUSE OF INDUSTRY.	*Per diem*, sixteen ounces of white bread, one quart of new milk, and one quart buttermilk for whey.				2 oz. of bread *per diem*, one quart of broth, one quart of new milk.	One pint of flummery *per diem*, one quart new milk, and 1 quart of buttermilk for whey.		
STEPHEN'S HOSPITAL.	Half a pound of bread, one pint of milk.	1, 2, 3, 5, 7 4, 6	1 quart soup, ½lb. bread, or 2lbs. potatoes. One pint milk or beer. 12oz. of bread, 1 quart sweetened gruel.			Daily—½lb. bread, two quarts new milk, and one quart of buttermilk.		
ROYAL HOSPITAL, PHOENIX PARK.	One pint oatmeal or rice gruel.		Half a pound meat, ½lb. of bread. One pound potatoes.	One pint of oatmeal or rice gruel.	½lb. meat, 1lb. bread, ½lb. potatoes, one quart beer.	Tea.	Half a pound of bread, made into panada or pudding.	
RICHMOND HOSPITAL.	One quart stirabout, one pint new milk.		Bread, 8 oz., soup, one quart.	Bread four ounces, new milk one pint.	Breakfast, bread, 8 oz., new milk one pint. Dinner, bread 8 oz., mutton or beef 8 oz., Supper, bread 4 oz. new milk one pint.	Flummery, one pint, new milk, one pint.		Half a pound of bread, one pint of milk.
RICHMOND LUNATIC ASYLUM.	A quart of stirabout, made of 7 oz. oatmeal, a pint of new milk.	1, 3, 5 2, 6 4, 7	16 oz. of beef, raw, supposed to produce, when boiled, ½lb.; 3lbs. potatoes, and a pint of small beer. A quart of soup or broth, with vegetables; 3lbs. of potatoes. 3lbs. potatoes, a pint new milk.	½lb. of bread, and a pint of small beer.	The medical attendants are empowered to make any alteration or substitution in the diet which individual cases shall appear to require.			
BELFAST HOSPITAL.	One pint stirabout, one pint new milk.		Half a pound of bread, one pint new milk.	One pint flummery, one pint new milk.	Breakfast, one quart stirabout, one pint new milk. Dinner, 2lbs. potatoes, one pint milk. Supper, one pint flummery, one ditto new milk.	*Per diem*—½lb. bread, one quart gruel, 2 pints new milk, half a pint flummery. Barley-water at occasions.		
BELFAST LUNATIC ASYLUM.	One quart stirabout, one ditto new milk.	1, 3, 5 2, 4, 6, 7	3½lbs. potatoes, one pint soup. Ditto, and one pint new milk.	Eight ounces bread, or a pint flummery, one-third of a quart new milk.	½lb. beef three days in the week.	As ordered.	As directed.	
CORK FEVER HOSPITAL.	One half quartern loaf for every four, and one pint new milk each. Under 12 years, half a quartern loaf for every 8.	1, 3, 5 2, 4, 6, 7	1 lb. beef and two of potatoes. Under 12 years ½lb. of beef and one pound potatoes. Potatoes and milk.	One pint of milk and one of stirabout, for adults; half do. for children.		½lb. bread, with milk and water sweetened.	Gruel, broth, wine and porter, as ordered by the physicians.	
FOUNDLING HOSPITAL.	4½ oz. meal in stirabout, and half a pint new milk for each child.		On week days, 11 lbs. of potatoes to eight children, and one pint milk each. On Sunday, ½lb. of meat each; broth and vegetables allowed.					
HOUSE OF INDUSTRY.	6 oz. oatmeal, in stirabout, one pint boiling milk.		On week days, 3½lbs. of potatoes, and a quart of vegetable porridge. On Sundays, 4 beef heads boiled in the porridge.					
MENDICITY ASYLUM.	6 oz. oatmeal, in stirabout, one pint boiling milk.		On week days, 2½lbs. of potatoes and a quart of vegetable porridge. On Sundays, 4 beef heads boiled in the porridge.					
LUNATIC ASYLUM.	8 oz. oatmeal in stirabout, one imperial pint boiling milk.	1, 3, 5 2, 4, 6, 7	Three pounds potatoes, and a quart of broth. Ditto and 1½ pint boiling milk.					
LIMERICK HOUSE OF INDUSTRY.	5oz. oatmeal, one pint new milk for adults; 4oz. meal in stirabout, and half a pint milk for children.		One stone of potatoes for six adults, or seven children; one pint of milk to the former, and half a pint to the latter. Meat occasionally on Sundays.		Nourishment to the sick, as the physicians may direct, tea, mutton broth, bread, wine, spirits &c. for patients, when ordered by the physicians. Other diet, as physicians direct.			
COUNTY INFIRMARY.	A quart of stirabout and a noggin of new milk.	1, 3 2, 4, 5, 6, 7	3lbs. potatoes, one quart soup, ½lb. boiled beef. Four pounds potatoes, and one pint new milk.					
LUNATIC ASYLUM.	Six to seven oz. oatmeal in stirabout, one pint new milk.	1, 3, 5 2, 4, 6, 7	For those who work, 6 oz. to 8 oz. beef or mutton, with vegetables and potatoes—the broth and potatoes for the others. 3lbs. potatoes and a pint new milk.	Six oz. wheaten bread, one pint new milk.	Bread, with milk—gruel and broth at discretion.			One pint of gruel.
FEVER HOSPITAL.	4 oz. bread, one pint milk.		Four ounces bread, one pint gruel.	Four oz. bread, one pint milk.	Meat, 12 ounces, bread, 16 oz. potatoes, 8 oz. oatmeal, 3oz. barley, ½ oz. sugar, 1 oz. salt, beer, one quart.	4 oz. bread, ½ pint milk.		
MILITARY HOSPITALS.	Daily—8 oz. meat, 12 oz. bread, 16 oz. potatoes, 3 oz. oatmeal, barley, salt, &c. 1 oz. sugar, 2 oz. new milk for tea.					Daily—4oz. meat, 8 oz. bread, 8 oz. potatoes, 1½ oz. oatmeal; sugar and milk for tea.		
LYING-IN HOSPITAL.	2d. worth, or 12 oz. bread, and one pint of milk.		4½ oz. of cullings, made into gruel, and half a pint of new milk for each person.	The same food and quantity as for dinner; besides every eight persons get as drink, meal tea in the course of the day—8 oz. of cullings and one pint of new milk made into meal-tea for every 8 persons; besides wine, broth, &c. &c. when directed by the physicians. No diet is allowed to be given from their families.				
COUNTY GAOL.	8 oz. of cullings made into stirabout, with one pint of new milk for each person. When bread is given, which is but seldom (say at Assizes time) each person gets, in place of the stirabout, ½lb. of bread or 2d. loaf.		4lbs. of boiled potatoes, with 1 pint of sour milk to each person.					

In connexion with the chapters on FOOD and DRINK, contained in this work, the above TABLE OF DIETARY was collected and arranged, at considerable trouble and expense, by the Author. It is designed to show the particular regimen selected for the sick, and peculiar to each district. This will greatly aid Committees in forming DIET TABLES, both in point of health and economy, for any Charitable Institutions. To his estimable friend, Dr. DUNCAN, of Edinburgh, and other Professors, the Author is obliged for the kind facilities afforded him in furnishing documents for this tabular view of aliment for the indigent and afflicted. "Est domus apta satis, est hic cibus utilis aegris."

J. MURRAY, M.D.

APPENDIX.*

THAT the healthy disposition of all parts of our bodies depends on the regular union of the elements of which they are composed, seems certain: any change in the composition, will be productive of some alteration in the organization, and, of course, in the functions of such parts. Many practical inferences might be deduced from such mutations. If the fibrine overbalances the due proportion of albumen, and extractive matter, in muscles, and if that fibrine be dry and rigid in its texture, then stiffness, contraction, and want of dilatability, will be the result. In the constitution of the fibres, the proximate principles vary with the different periods of life. In youth, the proportion of gelatine is larger; in adult age, that principle is very scanty, and fibrine abounds.† Is this the reason why the girl of eighteen, will bring forth during an easy labour, of an hour or two, whilst the woman of forty, in first labours, will require two or three days?

It is eighteen years since I began to state to my medical friends, that most cases of difficult or tedious labours, not depending on malformation, or disproportion, were retarded by some want of consent between the muscular fibres, and by the absence of easy dilatability and relaxation; and that the business of the practitioner, almost in

* See page 121.

† Dr. Craigie's Physiology, p. 490-491.

all cases, is, to DIMINISH RESISTANCE, NOT TO INCREASE POWER. Such want of consent in the action of muscular, and the other fibres, is observed to take place between the vesica urinaria and its neck, in retention of urine. In such cases, the bougie, if requisite, should be the only instrument used, *which being very slowly withdrawn*, is followed by the urine, during the production of the natural consent of action between the urethra, vesica, and its sphincter. Similar irregular contractions, and want of unison, take place during parturition, which are in many instances productive of delay.

That the rigid and unyielding state of the os uteri is in a great part owing to the hardness and too firm organization of fibres, may be shown by the circumstance, that it is oftenest found so in viragoes, and women of tense muscular structure, and in those who have had scanty, painful, and obstructed menstruation;* for in all places where the menses begin early, and are natural, labours are easy. In such climes, it is probable the quantity of the fluid is more abundant. Hippocrates estimates it at two hemina, about twenty ounces:—no such quantity is emitted in these climes, during health.

The idea that the unyielding texture of muscular fibres, is deducible from some causes producing too great tonicity, more or less approaching to an unnatural overbalance of solid matter, is confirmed from noticing the influence of habit, dress, diet, climate, disease, and medicine, in altering the flexibility, softness, and pliancy of muscular and other tissues.

The conformation of females, in uncivilized nations, differs in no degree from those inhabiting our regions. The pelvis and head of the child bear the same relative proportions to each other. The great and painful delay

* See Friend, Hoffman, Shaw.

which takes place, in the first stage, in these countries, must be owing to certain obstructions opposed by the unyielding parts, and to the consequent irregular muscular action.

Providence, which ordained that woman should bring forth in *sorrow and pain*, gave to the elegance of the female form the oblique and narrow pelvis, to support, in the erect position, the weight of the gravid womb. Yet, if we consider this beautiful structure, we will find, that the diameter of the pelvis is such, as to allow the comparative easy passage of the child, if no resistance were opposed, but that presented by the parietes of the basin itself.

"To add to the more effectual support of the gravid uterus, during gestation, all the soft parts concerned in labour are of a *firm and rigid texture*, dilating, at all times, with considerable difficulty, to such a degree as to permit the passage of the child through them, without laceration or other injury. It is obvious that these circumstances must render the act of child-bearing, *slow*, *difficult*, and *painful*."*

The pelvis is much more commonly well formed and regular in its dimensions, than most people suppose. The instances where tedious resistance is opposed by the bones, are comparatively rare. Farmers' wives, and persons of tense, rigid fibres, who are often two or three days in labour, are persuaded that the delay is owing to a narrow or ill-formed pelvis; and young practitioners sometimes adopt the same erroneous opinions; nay, they too often act accordingly. The forceps, and even the crotchet itself, have been used in cases where the same women have been safely and easily delivered, in succeeding labours, of strong, large children, in a few hours' ill-

* Dr. Osburn.

ness; to effect which, on former occasions, required as many days. It is plain, then, to persons of reflection and experience, that if the os uteri and the other soft parts were easily dilated, and opposed little resistance to the propulsion of the foetus, and that it met no obstruction or delay, except what is caused by the relative capacity of the bones of the basin, and head of the child, it is clear, that a great portion, indeed the principal part of the delay and danger might be prevented, and innumerable lives spared to their friends and society.

Dr. Dewees thinks, that we are for the most part to attribute the difficulty and pain attending human parturition, to the changes produced by civilization and refinement, and "not to the peculiar structure of the body." Little pain or trouble affect savages, or those who have not been injured by disease, or perverted by custom. "So little distress has the American squaw in her labours, that it never interrupts any project or enterprize she or her husband may have in view. If taken in labour when marching with him, she retires behind a bush, delivers herself, and quickly rejoins him."

Captain Wilson, in his narrative of the missionary voyage to the South Sea Islands, states, respecting the delivery of the Queen of Otaheite,—"It may be worthy of remark, that Iddeah had not been absent from our house two days before she appeared as if nothing had ailed her, with so little inconvenience do the most painful operations of nature affect those of that happy climate." Again he says, "No where are children brought into the world with less pain or danger: the women submit to little or no confinement within doors, but rise and go about as usual." He also describes the following custom: "When a woman brings forth a child, a kind of hut is raised within the house, with matting and cloth; heated stones are then placed with sweet herbs and grass over them, on these water is sprinkled, and she is closely shut up in the steam, which rises, till she is in a proper perspiration, and can endure the heat no longer. From this vapour bath she comes out, and plunges in the river, and washing herself all over, puts on her clothes; this she often repeats, which sometimes brings on the ague; nor can they be persuaded to desist from such a preposterous custom, such being the force of habit." In Africa, labours are easy. "The women of the African peasantry lead a life of the most listless inactivity. The mistress of the family, with her coffee-pot constantly boiling before her, on a small table, seems fixed to the chair like a piece of furniture: their feet and legs are regularly washed in warm water every night."*

When a difficult labour happens in tropical climates, it is usually found to belong to the preternatural or complex class. "Hot climates are, indeed, favourable to gestation and parturition, and difficult labours are not common." "Women lying-in, soon recover. Indians and Negroes often make it an affair of a few days, and sometimes of a few hours only, and then pursue their occupations."†

Mr. Brydone informs us, "that among the Sicilian women, labour is attended with so little pain or danger, that *they appear perfectly well the day after delivery*."‡

Mr. Swinburn also acquaints us, "that the women of Calabria bring forth their offspring, almost without a groan; and that it has become proverbial, 'that a Calabrian maid-servant prefers the labour of child-birth to that of a wash-tub.'"§

Reflection on, and experience of, the above circum-

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* Barrow's Travels in Southern Africa.

† Dr. Mosely on Tropical climates; also, Bruce's Travels and Asiatic Researches.

‡ Tour through Sicily and Malta.

§ Travels in the Two Sicilies.

stances, led me to the following consideration and conclusions:—That, by proper management, we may diminish or remove the principal cause of resistance. *That it is by lessening such resistance we do good*, and *not by attempting to increase the expulsive powers.* That by imitating nature, as nearly as possible, we may become possessed of certain means by which we may remove the obstruction which the tissues present; and thus, that we may approximate the nature of labours in our climates, so as to resemble more closely that process in other countries where obstacles arise only from disease, deformity, or particular conformation, and not from the tone or disposition of the animal fibres.

The *means* here referred to, must consist of external applications, and changes of temperature, producing either local or constitutional effects. The full consideration of the particular measures here alluded to, and which will be found closely connected with the theoretical opinions already set forth, will soon be submitted to the profession, in a separate publication, entirely confined to the obstetric department. I need not enter upon the subject in a dissertation so general as this. In the interim, if it can be of use to any practitioner, or prevent or alleviate the sufferings of a fellow-creature, I mention that the principal practical plans of treatment relate to the *early* and judicious endeavours to alter the local tonicity of the simple solids, whether hereditary or acquired, as will be further alluded to at the end of this chapter.

The various modes already resorted to, by other practitioners, though generally rather late, show, at least tacitly, the universal prevalence of the opinion, that most of the obstructions which occur in tedious processes of parturition, owe their delay, most commonly, to a want of ready dilitation.

I will only observe, in this place, that our endeavours should be, to produce RELAXATION without EXHAUSTION; to bring the constitution and muscular tone under the same kind of influence experienced after sickness, or residence in warm climates; to produce effects similar to those which nature induces in other parts of the globe. One thing I can aver, from my own observations, that females, who have lingering labours, from *rigidity*, *spasm*, or *contraction*, are more liable to easy dilatation or relaxation of the os uteri in summer, than in winter.

I am informed, that, after seven weeks' abstinence from animal food, during lent, women have easier labours than at other times,—I observed, certainly, that they had more speedy recoveries. It may be urged, that in those regions where labours are easy, the difference or peculiarities in the habits of life may occasion the chief influence; that the greater quantity of diluting drink, and the limited use of animal food, may cause that relaxation and pliability of fibre, so desirable, and so evidently beneficial. Observe how much a difference in food, affects the taste, firmness, flavour, and size of our domestic animals.

Dr. M'Donald proves, in his Inaugural Dissertation de Coctione Ciborum, that rice is the least nourishing food. Now, persons living on rice, sugar, fruits, and other soft diet, will certainly have their tissues more abounding in gelatine, albumen, osmazome, aqueous compounds, and *less fibrine*; and, consequently, will enjoy a more relaxed, dilatable, and soft texture, constitution or organization, than those who live on food abounding in azote, and tense or arid gluten, and producing an over-proportion of fibrine.

Whilst it is certainly rational to agree in some measure with this reasoning, and natural to suppose that the habits of life, the particular diet, drink, &c., may have their effects as well as that of climate, we must admit, that, in these countries, abstinence from animal food, and living on vegetables and milk, do not exempt the poor from rigidity, irregularity, spasmodic action, and inflammation of the mouth and neck of the womb. In fact, active working women, in the country, are most liable to such a state of the parts.

This leads me to conjecture, that cold, wet, and hardships, bad, damp rooms and floors, with light, thin clothing, particularly the injurious tight lacing, produce irregular, difficult and painful menstruation, derange the natural functions, disposition, and even organization of the womb; and that in this rank of life, the source of severe, protracted, and lingering labours, is entailed on many a girl in her early youth. Cold being the chief cause of rigid and tense tissue, the following case will illustrate the benefits of heat:—

A. Beck, an active little woman, who had several children, and was obliged to work at washing, to assist in maintaining them, had severe, tedious labours, at one of which I attended, and found the distress and delay entirely owing to *tension* and *rigidity* of the fibres and membranes concerned. When she had recovered, I advised her to quit her occupation of a washerwoman, to wear flannel drawers, change her lodgings from a damp, cold floor, to some warm garret, and to earn her bread by working in the warmest *cotton factory* she could find. Having suffered so much in former labours, she took this advice, entered a factory, wrought every day in a temperature exceeding 70° of Fahrenheit. In a year she became pregnant, and in nine months found herself ill,—walked from the factory to my house, to beg I would not be from home. In an hour after I was sent for, and in another she was well. The dilatation was easy—the child of the usual size. Here there was no enlargement of pelvis, since former labours, nor any additional force of uterine action, but an evident healthy, regular softness, and yielding condition conducive to easy parturition.

In lingering labours, the necessity of producing relaxation was long apparent to almost every practitioner. It was found that raising the patient to the erect position, and bleeding ad deliquium, favoured the relaxation of the resisting fibres forming the abdominal ring, and the consequent reduction of hernial tumours. The same means have been used in contractile or spasmodic action of the os uteri, and, undoubtedly, with considerable success.

This practice was greatly recommended by the distinguished professor of Midwifery, in 1807-8, at Edinburgh. The effects of venesection in removing the contractile irritability of the uterus, and irregular muscular action, are, no doubt, obvious and speedy. During the first five years of my practice, I repeatedly had recourse to venesection as a relaxant, and was much pleased with its beneficial consequences, both in facilitating the delivery, and in relieving the excruciating pains which irregular uterine action never fails to occasion. The beneficial consequences of bleeding, were also often apparent in the speedy recovery of the patient, and in the prevention of fever, head-ach, convulsions, and irritation. It failed, however, sometimes, to produce the expected dilatability of the passage. In a few instances, it caused great debility; and, on two occasions, I fear, it was decidedly injurious.

One was the case of —— Houston, a poor woman of passionate temper, and robust fibre. She had one child, five years old,—again became pregnant, and, at the time of her illness, I was called to visit her, when she had been fifteen hours in severe pain; the cervix uteri contracted rigidly, and the orifice remained hard, hot, throbbing, and unyielding. She was raised to the erect position, and sixteen ounces of blood were taken from the arm. On becoming weak she was laid in bed; soon after the relaxation commenced, and in a few hours she was delivered.

On warming in bed, and having drank some tea given by an attendant, untoward uterine hemorrhagy commenced. On reaching the house again, the usual means recommended were immediately used; but the weakness was most alarming. In thirty hours the curious fever of re-action, which succeeds depletion, came on; the pulse extremely quick and small, scarcely to be counted. The woman was confined in a small damp room, had foul air, and bad diet. Anasarcous swellings supervened soon after, and the poor creature died of debility and dropsy.

It may be more candid than prudent to describe this unfortunate case,—one which I have reflected on with deep regret. I have been led to believe, that the bleeding, though it hastened the dilatation, abstracted that activity from the uterus, which is so beneficial in promoting its healthy contraction after delivery; and which is so essential for expelling the secundines, approximating the parietes of the uterus, and closing up the mouths of the vessels of that viscus.

Another bad effect of the blood-letting arose from this; that the quantity taken from the arm, added to that discharged during the subsequent hemorrhagy, greatly increased the debility. If the woman had only lost that portion evacuated in flooding, it is probable she might have survived.

Now, though women in the lower walks of life generally bear bleeding better than those of higher rank, yet the want of nourishment, care, and attention, of which they are deprived, may increase their weakness, and render their recovery more tedious and uncertain.

The operation of bleeding is liable to objections, from the impression of danger it is calculated to make on the minds of the patient and her friends. It is very perplexing in depriving her of the use of the arm during her exertions; it is troublesome and vexatious, if the vein should happen to burst open, when she attempts to hold something during a pain; above all, it is objectionable from its effects in suspending the necessary irritability and concractile powers of the uterus, after delivery; and from its danger of reducing the woman too low, if uterine hemorrhagy should unfortunately supervene.

The internal exhibition of opium, is another remedy, now much used. It is particulary recommended in removing and suspending false pains and irritability, and affording ease and repose, until the accession of real labour. To produce this effect, however, it must be given in a full dose; for, if administered in quantities insufficient to allay the irregular spasmodic pains, it only adds to the irritation it was meant to remove

When the labour itself has commenced, and proceeds in the lingering state, it would then be very injudicious to administer opium. It acts, at least in the first instance, as a stimulus, and augments that resistance which it should be our object to diminish or remove. This should be particularly attended to, where the os uteri becomes hot, throbbing, and inflamed. "The inflamed state of the part is often indicated by its heat and dryness; but whenever it is extremely rigid, and there has been a long continued exertion of the uterus, with little or no advantage, *the impediment to the progress of labour being clearly occasioned by the resistance made by the os uteri*, I believe it is right to consider that part as inflamed, provided there be apparently sufficient pains."* Here I would reprobate the use of opium; and if bleeding were at all resorted to, it should be in such a case, next to that

* Dr. Denman.

of puerperal convulsions, where copious venesection is indispensable.

I have already alluded to the facility with which women bring forth, when debilitated by anasarca or consumption. The fact is well known, that many women, who have suffered from bad health during pregnancy, and who feel the greatest alarm about the event of their accouchment, are sometimes most agreeably surprised, by being subject only to a few pains. In such cases, the attendant cannot overlook this observation, that the tissues are pliable and soft, and assume an evident disposition to easy dilatation. This may be more clearly elucidated, by a case or two from a great number which could be adduced.

Mrs. R. had three children at former periods; she was ill each time from twenty to thirty hours,—her constitution was robust, and fibres tense. In the summer of 1809, she became subject to *leucorrhea*, from great fatigue.

This continued, at intervals, during three years, accompanied with weakness, and pain in the back and loins. At this time she became again pregnant. During her gestation she was much relaxed and debilitated, and entertained a strong presentiment of sinking under her approaching accouchment, which she was afraid would be attended with the former severity and delay. At the proper period, the labour commenced,—the pains, she said, were not so grinding or cutting as before. The uterus and soft parts expanded readily, and she was delivered in two hours, with comparative ease, of a fine child, which she affirmed to be superior in size to those she had brought forth before, with so much anxiety and affliction.

E. M. had two children. She had been long in labour at each time,—the first child had been delivered with the aid of forceps. During her pregnancy, she enjoyed her usual rosy health, and was active in the management of her house. About the seventh month she was infected with lues, by her husband. Unwilling to expose his drunken foibles, he procured a quantity of mercurial preparations, gave them in large doses for many days, and produced copious salivation, which lasted five weeks. At this time labour commenced; she was much reduced, and it was supposed she could not survive, nor have strength to undergo her usual lingering and violent labour. I was called in, and found the os tincæ soft, moist, and thin, the fibres relaxed, with every requisite disposition to regular and easy parturition,—a few pains only were requisite. She recovered rapidly, and, during her short illness, took occasion to congratulate herself on the difference between this easy labour, and the cutting, sharp, writhing pains which she formerly endured.

These, and many other cases which might be mentioned, though they are not to be exactly imitated, yet they prove strongly the altered disposition assumed from relaxation and weakness. This would argue the propriety of using even *constitutional*, as well as *local means*, which might render the tissues relaxed, soft, and yielding, where they are firm and rigid, and when obstructions are owing merely to resistance from the texture of the simple solids, and the tense or robust state of the muscular fibre in general.

> "Multa renascentur, qua jam cecidere: cadentque
> Quæ nunc sunt in honore."*

The relief often succeeding nausea, and even vomiting in labour, suggested the practice of bringing them on by

* Horace.

art. But their employment, among ignorant persons, would do much harm; and, therefore, the prejudice against the use of nauseating medicine is strong and prevalent. The very experienced Dr. Hamilton objects to their use, lest a blood-vessel might be ruptured, though we seldom find that such a circumstance takes place in vomiting, where no medicine is given. *Where every thing is in regular progress, it would be inhuman to interfere: it is only where necessity, and when a proper time is chosen and early attended to, that any medical interference can be at all admissible.*

I have for some time been able to form an opinion, even on conversing with the patient and friends, whether I may expect to find the uterus disposed to dilate readily or not. For this purpose I endeavour to obtain certain information, respecting the previous history, disposition, and temperament, whether the menses, and even the digestive organs, have been regular. If the menstruation have been commonly irregular, deficient in quantity, and attended at each period with pains, irritability, and nervous excitements, I have, then, in most cases, found the uterine action irregular during labour, the os tincæ rigid, the woman liable to cold shivering, and to long-protracted, gnawing, unprofitable pains.

On carefully learning the previous state of the patient, and ascertaining that rigidity or spasm of the os uteri opposes the completion of the first stage, and that no disease or malformation pre-exist:—in such cases endeavours have reasonably enough been made to bring on relaxation, both general and local, to connect the constitutional and uterine dispositions; to remove spasmodic action, and accelerate the efforts of the diaphragm and abdominal muscles.

How does Nature produce these valuable desiderata in lingering labours? Where she acts in a regular manner, it is partly by the assistance of the propelling action of vomiting, but principally by the dilating effects of nausea; where the uniform consent obtains between the uterus and stomach; vomiting is occasioned, and then the union of action between those organs is followed by the consent of disposition with the entire system. "*By vomiting, the labour is very much forwarded; every fit of vomiting, according to popular observations, doing more service than several pains, partly by the increased pressure, and partly by the succeeding relaxation.*"*

Now, when nature produces these happy effects, it is well; but, where that strict and intimate connexion does not exist, between the stomach, nerves, and uterus, then I would certainly endeavour to imitate nature, and to produce it by art. If we alter the condition of one organ, we change the state of the other: whatever affects the stomach, will, by a sympathy no way difficult to comprehend, equally extend to the womb.

Though I was long aware of the utility of nausea, in *lingering labours*, producing many of the good effects of bleeding, without their dangerous consequences, yet I prefer using the vapour bath, fomentations, &c. as well as relaxing applications, in cases of spasmodic stricture, lest the exhibition of nauseating medicines might injure the head, in case vomiting came on, or be productive of any mischief to the perinæum, or other parts; or, lest their use might become too general, and be abused by being given where not required, or likely to prove beneficial. I had hopes of determining on some local application, from which good effects might be derived; and I still retain the opinion, that such may yet be found. We see how various remedies exert peculiar influence on particular organs: one medicine inverts the natural

* Denman.

action of the stomach, another excites the peristaltic motion of the bowels, a third acts as a sialagogue, and a fourth affects the nose as an errhine; it is therefore natural to suppose, that the sensible uterus would be also subject to the influence of a particular local agency.*

During the time I was investigating the above very interesting subject, and revolving in my mind whether there would not be a more justifiable mode of producing nausea, and consequent relaxation, than by vomiting, and the deliquium which follows it, I was the more encouraged in the investigation by the event of the following case:—

A. T. æt. 29, was ill in her first labour two days. She was a stout, robust woman, of passionate temper, and had been liable to irregular and painful menstruation When she had suffered a considerable time, I was called in, and found the pains apparently very severe, but producing little or no effect. The *orificium uteri* remained quite contracted, forming a thick ring. On the evening of the second day, soon after I saw her, she was advised by a friend to *smoke* a pipe of tobacco, and swallow the smoke. This, it was alleged, would bring on vomiting, and speedy relief. I was consulted, and being anxious to observe the effects of artificial relaxation, I did not discourage the proposed trial. She had not smoked long, till she became very *sick* and *faintish*, and soon after began to vomit freely; the pains ceased for an hour, and, on examination, the os uteri was found thin, soft, and more than one-third dilated;—a few pains terminated the first stage, and she was safely and speedily delivered.

Having written the substance of these pages to my brother, then Assistant-Surgeon in the 60th Rifles, at the

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* The effects of the ergot of rye, discovered long since this was written, prove this hypothesis to be well founded, so far as an internal medicine is concerned.

Cape of Good Hope, he mentioned that a plant called *dyka*, or wild *hemp*, which grows on the eastern coast of Africa, is used by the natives for this purpose; and that they all, male and female, smoke it to bring on perfect relaxation and relief from pain and spasm of any kind, during its relaxing influence.

Mrs. Blair had two children, after most severe and tedious labours,—in both, forceps were used. She suspected malformation of the pelvis, and was so much alarmed at the approach of her third labour, that she resolved to go to Glasgow, where she had a daughter. I then saw her for the first time; she consulted me on the propriety of going, which I did not discourage. On the night she sailed she became sea-sick, and vomited freely and repeatedly, which she had not done in her former labours; she had a few pains, but not like those to which she had been formerly subject; the nausea and sickness continued, during which her child was born, large and strong, to her great astonishment and delight.

It is not a little curious, that though the valuable effects of relaxation were well known to every observer of the process of labours, pleasing to the patient, and encouraging to the attendants, yet that, as far as I can find, these important advantages are not sufficiently appreciated in the obstetric works of our authors. Where I have not had a sufficient early opportunity of employing the mode alluded to, page vi. Appendix, of *altering the tonicity of the simple solids, and relaxing their rigidity, whether hereditary or acquired, by the long-continued imbibition of tepid watery vapour;* or where the patient or friends have rejected the trial, or declined to persevere in the use of *judicious fomentations, diffused from antispasmodic and emollient decoctions;* then I have occasional recourse to such temporary means of promoting artificial relaxation, as the circumstances and shortness of the time permit me to recommend.

In such cases I endeavour to assist nature, and to bring about the agency which, in her aberrations, she may postpone or omit. When nothing indicates the impropriety of the practice, and true labour has continued much longer than usual, then I have seen it useful to begin the use of the *Vin. Ipecachuanæ, parvis et repetitis dosibus, primo ad nauseam, et aliquando ad vomitionem leniter ciendam.* I certainly observed, that, as the pores are opened by this remedy, the patients are less liable to febrile or ephemeral complaints after their accouchements. Pending the labour is not the best period, however, to induce an altered condition of the living texture; that is a matter requiring marked attention, for some time before.

Various means have been tried as preventives of spasms and rigidity, during the last months of pregnancy, the best of which were *fomentations,* and, also, *frictions every night, with such warm medicated oils,* as are spoken of at page 22. Fortunately, it is seldom that any artificial interference is justifiable; and, consequently, it is long before a decided conclusion can be formed or established by a single individual; to arrive at which is my principal reason for submitting these remarks to the profession, at much greater length than was at first intended.

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