

Thoughts on the effects of the application and abstraction of stimuli on the human body ; with a particular view to explain the nature and cure of typhus / by James Wood.

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THOUGHTS, &c.

THOUGHTS

ON THE EFFECTS OF THE APPLICATION AND ABSTRACTION

STIMULI

TO THE HUMAN BODY:

WITH A PARTICULAR VIEW TO THE NATURE AND CURS

OF THE DISEASES

BY JAMES WILSON, M.D.

ONE OF THE PHYSICIANS TO THE UNIVERSITY OF PENNSYLVANIA, AND MEMBER OF THE MEDICAL SOCIETY OF PHILADELPHIA, AND OF THE AMERICAN PHILOSOPHICAL SOCIETY OF PHILADELPHIA.

PHILADELPHIA: PRINTED AND SOLD BY W. CLAYTON, 1800.

IN A SMALL PAPER, PRICE 25 CENTS.

AND BY THE AUTHOR, AT HIS OFFICE, NO. 10 N. SECOND STREET.

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Of the nature of the human body, and of the effects of the application and abstraction of stimuli, it is a subject which has attracted the attention of philosophers, and has been the subject of much speculation and controversy. The author has endeavored to present a clear and concise view of the subject, and to show the connection between the different parts of the system. The work is intended for the use of students of medicine, and of the general reader who is interested in the subject.

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APPLICATION AND ABSTRACTION
OF
STIMULI
ON THE
HUMAN BODY;
WITH A PARTICULAR VIEW TO EXPLAIN
THE NATURE AND CURE
OF
TYPHUS.

BY JAMES WOOD, M. D.

ONE OF THE PHYSICIANS TO THE DISPENSARY, AND MEMBER OF THE PHILOSOPHICAL AND MEDICAL SOCIETY, OF NEWCASTLE UPON TYNE; AN EXTRAORDINARY MEMBER OF THE ROYAL MEDICAL SOCIETY OF EDINBURGH, &c. &c.

At nostris bene computentur anni,
Et, quantum tetricæ tulere febres,
Aut languor gravis, aut mali dolores,
A vita meliore separentur:
Infantes fumus, et senes videmur.
.....
Non est vivere, sed valere, vita.
Mart. Lib. vi. Ep. lxx.

O Temperance! thou goddess most worthy to be adored! thou patroness of health! thou protector of beauty! thou prolonger of life! thou insurer of pleasure! thou promoter of business! thou guardian of the person! thou preserver of the understanding! thou parent of every intellectual improvement, and of every moral virtue!

DEFORMITY, an *Essay*, by *W. Hay, Esq.*

L O N D O N :

PRINTED FOR J. MURRAY, FLEET-STREET; AND W. CREECH, EDINBURGH;
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1793.

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OF THE MEDICAL AND SURGICAL SOCIETY OF LONDON

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STIMULI
ADVERTISMENT

THE following paper, which has been read in the month of August, 1792, in a more condensed form, than the Philosophical and Medical Society of London, since which period, by the faculty of the practice, founded on the theory proposed, and by the favourable opinion of a distinguished body of the Society's friends, has attracted the public attention.

R21797

ADVERTISEMENT.

THE following "Thoughts" were first read, in the month of September, 1792, in a more condensed form, before the Philosophical and Medical Society of Newcastle; since which period, by the success of the practice, founded on the theory proposed, and by the favourable opinion of it expressed by many of the Author's friends, he is induced to offer the whole to the public attention.

JAMES WOOD, Esq.

STATIONER IN BARRICK UPON FARRIS

ADVERTISEMENT

TO the pleasure which as a Son I now address
to my dear Mother, I have the honor to inform
of respect to whom it is due, and that I have every
year, in the month of September, 1791, published
a new edition of my book, before the public, on the
subject of the Theory of the Earth, which I have
with much pleasure, and in a manner, which I
now think, is the best of the kind, published
on this subject, and that I have the honor to the Work
which I now present to you, and the approbation you
have expressed in your letter, and the given me
of honor, to be assured, it offers many new propo-
sitions, and is a source of information, which neither time
nor circumstance, can diminish, or dilute.

Your affectionate Son,
JAMES WOOD

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JAMES WOOD, Stationer in Barrick upon Farris

T O
JAMES WOOD, Esq.

SURGEON, IN BERWICK UPON TWEED.

SIR,

TO the pleasure, which, as a Son, I now add that, which, as a Professional Man, I feel, in paying a tribute of respect to whom it is due; and this is, from every one, your claim, as an experienced, and successful practitioner in Medicine, but particularly from me, on this occasion, as you, for more than thirty years, have pursued, with much success, the practice, the theory of which I now endeavour to explain.

This, Sir, I consider no small sanction to the Work, which I now PRESENT you; and the approbation you have expressed of it, with the opportunity, now given me, of declaring the satisfaction I derive from your approbation, are sources of happiness to me, which neither time, nor circumstance, can diminish, or disturb.

I am, Sir,

Your affectionate Son,

JAMES WOOD.

*Newcastle upon Tyne, }
February 11, 1793. }*

JAMES WOOD, JR.

NEW YORK, IN RESPONSE UPON THE

TO the pleasure which, as a son, I now admit
to feel, as a Father, I feel in giving a tribute
of respect to whom it is due, and this in every
and your claim, as an experienced, and successful pro-
fessor in Medicine, has particularly from me, on this
occasion, as you, for more than thirty years, have pursued
with much success, the practice, the theory, which I
now endeavor to explain.

This I consider an equal tribute to the World,
which I now present you, and the reputation you
have acquired in it, with the opportunity, now given me,
of detailing the facts, and giving you your opinion
that, are found to be applicable to me, which neither
my own experience, can furnish, or inform.

I am, Sir,
Your affectionate son,
JAMES WOOD, JR.

New York, May 18, 1803

P R E F A C E.

IN this illumined æra, when the mists of darkness, which hung over almost every science, are fast dispersing by the clear light of discovery, Medicine has to boast of its attainment of a large share of those valuable rays, the bright emanations of the genius of a MONRO, a HUNTER, a CULLEN, a GREGORY, a WINTRINGHAM, a VERSAUR, a LETTSOM, a HIGGINS, a BLACK, a HEWSON, a PRIESTLEY, a CRAWFORD, a LAVOISIER, and of others, and consequently, of the diminution of the number, in the dire list of those diseases, which its professors were obliged to distinguish by the epithet *incurable*. A few of that dreadful catalogue still remain, and *Typhus* has no claim to be yet excluded from the number; surely therefore, the efforts of any one to illustrate the nature of a disease, so common, and so frequently fatal, must be every way desirable; and may

we not hope, that, from repeated attempts, its theory may be gradually enlightened, and one of the crowded avenues to the grave may be closed? And may we not also safely predict, judging from the rapid progress acquired in the knowledge of philosophy, and medicine, within a very few late years, that, by similar attempts, every disease, whose nature is any way obscure, may be at last clearly explained, and the professors of medicine may find themselves in possession of the *Ne plus ultra*, of the temple of truth itself?

To obtain this happy result of the efforts of united genius, an object which almost dazzles the perspective eye, we must more closely pursue the path of simple nature, and be convinced, the nearer we are to her, the sooner we will approach the end; already has all our additional knowledge proved this fact; and, strange to reflect, it appears to be the chief labour of the present

sent

sent age, to recal from deviating ways the whole ideas, I may almost say, of the ancient professors. I need adduce only one instance in proof of this; the singular mortality among the young of the human race, which has been frequently calculated at no less an average, than that *one half* of them die before two years of age; more late calculators have supposed the average to be only *one third*, which is still a dreadful truth, and can only be explained, as the effects of intemperance, and of deviations from the Hygæian path of nature.

I will on this occasion, as well as on any other, when I may venture to give my ideas to the world, most carefully avoid the *rage* of theory, and will never allow myself, through the violence of defending my opinions, to collect only what is favorable, and reject whatever is inimical to those I have formed; which has been too often the cause of illusion, and retardation

in the progress of physics; but I will coolly state unexaggerated facts, and deliberate observations. On this subject, I cannot resist adding, how cautiously we should permit *novelty* alone to influence the mind, either in theory, or in practice, examples of which, are too numerous, and notorious not to be known, and many too ridiculous to be acknowledged!

Equally sensible of these frailties of our nature, and of the importance of the extensive, and difficult subject, which I have at present undertaken, I am filled with apprehension at the idea of my not being able to pursue it, with satisfaction to myself, or to the world. I therefore would wish this attempt to be considered only as the *outlines* of a theory, which, if it be founded on any truth, may receive the digestion of time, and the correction of farther experience, and may hereafter be rendered a more perfect structure.

If,

If, however, there should be found in these thoughts, any, beneficial to medicine, or explanatory of any 'obscure part of physiology, I can only claim the merit of application, and observation, as I do not pretend to apply the result of any experiments of my own, but of those of others.

Notwithstanding neither the theory, nor the practice, of the late Dr John Brown, can be received by any rational physician, and this his most enthusiastic admirers now acknowledge, yet a part of the former, has tended to explain, in the most simple and satisfactory manner, many parts of physiology, before involved in much obscurity, and is now received, and established, in the most respectable schools of medicine. I will not point out, how far the theory, which I now offer, differs with that of Dr Brown, and how far it rests on the same foundation, as it will immediately appear to those, who are acquainted with Dr
Brown's

Brown's theory ; I will only remark, though, however mistaken and dangerous he may have been in his practice, or however his general theory was buried in errors and superfluities, yet the doctrine of irritability, to which his theory gave being, will ever remain, at once, an enviable monument to his memory, and an invaluable acquisition to physiological knowledge.

Dr Cullen's Theory of Excitement and Collapſe agrees with a part of Dr Brown's theory ; but Dr Cullen has never hinted at ſuch a ſtate of the muſcular fibre, as that of *accumulated* irritability ; to explain this ſtate, he is obliged to uſe the term *ſedative*, which he indifcriminately applies to the effects of opium and of cold.

Every application of chemical knowledge, which I have made on this occaſion, is the reſult of the experiments of Lavoifier ; and, as I imagine his theory and nomenclature, are now generally acknowledged to be
founded

founded on the trueſt principles, I will apply them both to my ſubject, and in doing ſo, I will always conſider them as received and eſtabliſhed axioms.

It may not perhaps be deemed ſuperfluous to relate the origin of the following thoughts. Having, in repeated inſtances, exhibited the *bark* in *Typhus* unſucceſsfully, and it having been taken, in many of thoſe inſtances, in the moſt advantageous manner, I naturally began to doubt of the efficacy of this medicine in *Typhus*, and to feel the impoſſibility of my ever again relying on its powers alone. I therefore took into conſideration the circumſtances attending thoſe who recovered, and the whole of the ſymptoms of the incipient and advanced ſtage of the fever; and I perceived, that thoſe, who recovered, enjoyed, in a great degree, the means of preventing, and correcting the tendency to a putreſcent ſtate; and that thoſe, who died, exhibited

bited that state, in a great degree, and during the course of the fever, discovered a particular anxiety, and oppression, in the act of respiration, and daily exhibited new symptoms of exhausted energy and strength.

At this time, a coincidence of ideas forced themselves on my mind. I recollected the symptoms of accumulated *carbone* in *Typhus*; I recollected that *carbone* was continually accumulating in the system, in a state of health, and was carried off, in the form of *carbonic acid*, by its combination with *oxygen* in the lungs; and it occurred to me, that the oppression, and anxiety in respiration, common in *Typhus*, might proceed from the deficiency of *oxygen*, to carry off the accumulated *carbone*; I therefore concluded, that if *oxygen* could be exhibited, by any means, into the system in sufficient quantity, to combine with the superfluous morbid *carbone*, that the tendency to putrefaction would be checked, and the fever diminished. During

During these considerations, a medicine was brought to my remembrance, which had been used, with the greatest success, in this fever, to a very great number of patients*. I recollected, that this medicine, which was Nitre, contained *oxygen*, in a great quantity ;—and also, as *oxygen* forms the basis of all acidity, that many other acids, as well as the *Nitric*, might have a similar effect.

Every observation, that I had made, having also induced me to consider an *exhausted* state of the irritability of the muscular fibre, and of the excitability of the *solidum vivum*, to be the common cause of death in *Typhus* ; and as different causes of death have been assigned, by many authors ; I will endeavour to shew the probability of the cause, I have mentioned, without considering that of any other cause,

B which

* By the Author's Father.

which has been assigned. I must also here declare my intention, of neither discussing any other theory, on this subject, nor any other theory, in physiology, but merely advance my own; and, as I do not mean to make quotations from any author, on account of the labyrinth, to which such quotations might often lead; I hope I shall be excused, if I ever adopt a part of any theory, or opinion, besides those which I have generally acknowledged, without reference to the author.

As I wish to give a simple, concise, and perspicuous view of the theory I entertain, I will avoid every amplification, which might result from any part of it; and also, to answer this intention more fully, I have formed two Scales, by which it may be exhibited, at one condensed view.

It is, therefore, in order to give some foundation for these several opinions, and to endeavour to make them probable, that
I have

I have *thrown together* the arguments of this work ; of these, I am conscious of not being able, on a first attempt, to form a solid whole ; but I will always take care, that the basis of each shall not be entirely hypothetical ; and I will wait for the verdict of time, on the truth of the conclusions, drawn from the combination, and result of all.

Before I close this preface, let me declare myself a candidate, for the favour and indulgence of those, through whose ordeal this essay may pass—its author easily imagines, that in a *first essay*, he may be liable to the severity of criticism ; but let every imperfection be balanced, by the unobjectionable safety of his doctrines, and by the sincere desire of being of use to mankind.

ARTICLE VI

I have shown the efficacy of attraction
 in the application of a magnet to iron
 being... on a... to be...
 STIMULI
 that the... of... is... the...
 by... and I will... for the...
 HUMAN BODY
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 WITH... the... and
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 clear... for the...
 of... whole...
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 led the... which is...
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 cause... to...
 called the...
 and the... which does not... the
 power of... but that of...
 impulses and of... called...
 THROUGH

THOUGHTS
ON THE EFFECTS OF THE
APPLICATION AND ABSTRACTION
OF
STIMULI
ON THE
HUMAN BODY;
WITH A PARTICULAR VIEW
TO EXPLAIN THE
NATURE AND CURE OF TYPHUS.

IN the human living body, there are distinctly perceived, three different kinds of solid matter; one, which possesses only the properties of all inanimate matter, called the *simple solids*; another, which is distinguished by the power of contraction, called the *living solids*, or the *muscular fibre*; and the third, which does not possess the power of contraction, but that of receiving impressions, and of sensation, called the *medullary fibres*, or the *nervous system*.

On

On the first, or simple solids, it will not be necessary here to enlarge, nor on the properties, which the muscular, and medullary solids, possess, in common, with the inanimate simple solid; but only, on the particular characteristics of each; the power of contraction of the one, and of sensation of the other.

It has been supposed, by many physiologists, that the matter of the muscular, was the same as that of the medullary fibre; and that the former, was a continuation of the latter, differently organized. It is equally applicable to the theory I entertain, whether the one is, or is not, a continuation of the other; yet, as the muscular fibre possesses a power of contraction, which the medullary does not possess, I will consider them as distinct matter; but it is not necessary here, that I should take a view of the influence, or connection of the one, on, or with the other; or take any metaphysical

cal

real view of the medullary matter; I am only to consider the property, which each possesses, of being acted upon by stimulant powers; and the property of sensation in the medullary fibre, when acted upon by any stimulus, I have named, in the scale I have drawn, *excitability*; and the property of contraction in the muscular fibre, when any stimulus is applied, I have named *irritability*; and as I shall always consider these two separate powers to be coeval, and existing in an equal ratio in each, I will confine myself to the consideration of the irritability of the muscular fibre, it being always understood, that whatever applies to this, the same is exactly applicable to the excitability of the medullary matter; I only wish to preserve both these terms, for the sake of clearness, and perspicuity, and to avoid all controversy on the subject.

The greater or lesser stimulus, required to excite the same degree of contraction, in a
muscular

muscular fibre, will prove the existence of less, or more, of irritability, in that fibre; when so much irritability exists, as to be capable of being acted upon by the weakest stimulus, this I will term *a state of ACCUMULATED irritability*; and when, on the contrary, no contraction can be produced, but by the application of a powerful stimulus, this I will term *a state of EXHAUSTED irritability*.

As life only exists, by the continued application of stimulant powers to the body, I will next take notice of some of these stimulant powers, consider their comparative nature in general, and afterwards, their first, and ultimate effects on the human body.

As it is now established in chemistry, that there is not such a state as *cold*; every degree of cold, even the most extreme degree, with which we are acquainted, being only a diminution of heat; so, in physiology,

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gy, it may be received as an axiom, that there is nothing in nature possessed of a *sedative* * power, but that all matter is STIMULANT; and that, which is called *sedative*, is only a diminution of the STIMULANT power †.

The first great, and most general, stimulus in nature, is the atmospheric air; and, by the most accurate experiments of Lavoisier, he has proved, that the stratum of air, which we inhabit, is composed of two different aeriform fluids, one of which he calls *azotic gas*, the other *oxygen gas*; and that these two *gasses* exist in the proportion of 73 of *azotic gas* to 27 of *oxygen gas*. He has also shewn, that the base of *azotic gas*, or *azote*, which name he has given to

* This *term* is here used, with the idea commonly annexed to it; as the *opposite* to STIMULANT.

† The effect, called *sedative*, has been applied, by some physicians, to the operation of different articles of the *Materia Medica*, which are highly stimulant, to opium, camphor, &c. and with some propriety; as the more the irritability is *exhausted*, the more *sedative* will be the state of the muscular fibre.

that air, called by Dr Black *bad air*, and by others *mephitic air*, forms, with *caloric*, *azotic gas*, and that it cannot be breathed by animals, but is destructive to animal life; neither will it admit of the combustion of inflammable bodies, nor of the calcination of metals: And that the base of *oxygen gas*, or *oxygen*, by which name he distinguishes that air called vital, or dephlogisticated, in its union with *caloric*, forms *oxygen gas*, which is highly capable of respiration, and of contributing to animal life, in which metals are calcinable, and combustible bodies will burn.

However various and opposite have been the opinions of philosophers and physiologists, of the object of the singular function of respiration, yet all agree that it is essential to life, and that it cannot be suspended for any time, without exposing the animal to the danger of immediate death. It is also universally agreed, that air, or an elas-

tic fluid, is received into the lungs in inspiration ; and it is also very well known, that there are many kinds of air, or elastic fluids, which animals cannot breathe, without perishing, as soon as if they had no air to respire.

I might here enumerate the opinions and theories of many eminent men, particularly of Crawford, Hewson, M. Cigna of Turin, and more particularly of Dr Priestley, and observe, how gradually they have approached to truth ; but such would be altogether superfluous : I will therefore only relate that, which is founded on the late discoveries of Lavoisier, the accuracy and beauty of whose experiments carry with them irresistible conviction. He has shewn, that only that part of our atmosphere, which he calls *oxygen gas*, is capable of contributing to animal life ; that this is received into the lungs of animals in inspiration ; and that fixed air, or *carbonic acid*,

is thrown out in exspiration; and that *azotic gas*, the other part, which forms our atmosphere, enters the lungs with the *oxygen gas*, and departs from them, without change or alteration. He has also shewn that *oxygen* with *carbone*, or the base of charcoal, forms *carbonic acid*; and as this acid, in the state of air, is thrown out of the lungs in exspiration, he concludes, that the base of the *oxygen gas* meets with *carbone* in the lungs, and forms the *carbonic acid*. And as he has also shewn, that *oxygen* with *hydrogen*, forms water; and as there is water thrown out of the lungs, in form of vapour, it is a reasonable conclusion, that a part of the *oxygen* received into the lungs, unites with *hydrogen* there, and forms the water which is exhaled. And Lavoisier has also calculated that it requires 85 parts of *oxygen* to 15 of *hydrogen*, to form water; and 72 parts of *oxygen* with 28 of *carbone*, to form *carbonic acid*.

From

From the whole, this conclusion may be drawn, that it is the *oxygen* of the atmospheric air, which is necessary to life; that “in this immense magazine of *oxygen gas*, all animals live and grow,” and that the general abstraction of it, for a few minutes, would render all animal nature a lifeless mass. The chemical powers of *oxygen*, therefore, are obvious; and its stimulant powers will easily be admitted, when we consider, that without it, the action of the heart instantly ceases; yet, at the same time, it appears to be the mildest stimulus, with which we are acquainted, as its action is never followed by any exhaustion of the irritability of the muscular fibre; but it rather seems to be *the power which restores the irritability*, whether accumulated or exhausted, to that state, known by the state of health and waking.

Water is the next general stimulus to air; and there is reason to believe, that
its

its stimulant effects on the body exactly correspond with those of the atmospheric air; with this difference perhaps, that the *hydrogen*, combined with the *oxygen*, may prove a stronger stimulus, and tend to produce, in a small degree, an exhausted state of irritability.

Vegetables seem the next stimulants in gradation; they are composed of *oxygen*, *hydrogen*, and *charcoal*, in different proportions, and some also of *azote*, and exhaust irritability more than air or water. Animal matter is still a higher stimulant; containing, besides the constituent elements of vegetable matter, always *azote*; *hydrogen* in greater quantity, and *phosphorus*, and *sulphur*. Vinous, and spirituous liquors, are still more powerful stimulants; and also different substances of the *Materia Medica*, such as opium, camphor, cantharides, &c. of these different stimuli, I will only here generally remark, that in exact proportion

to

to their stimulant powers, they will, when applied to the body, in any given state, produce more or less an exhaustion of irritability; more particular marks of which will be evident in the consideration of the Scales I have made.

There are other stimulant powers, besides those, which are received into the lungs and stomach; I mean, certain impressions made on the external senses, and certain sensations of the mind. Of the former, light, and sounds, are the most general; light acts as an universal stimulus; its presence enlivens all nature, and with its departure, the animal, as well as the vegetable kingdom, *naturally* sink into the state of sleep. Different sounds act also as powerful stimulants: the trumpet and the drum afford the soldier instances of this; and the melody of different musical instruments tells the truth strongly to the musical ear.

Different objects presented to the eye, or
to

to the mind, prove likewise powerful stimulants to the body; and these are all such as make an agreeable impression on the senses; such as hope, joy, &c. and also there are a few, though not of the agreeable kind, which, by exciting sensations of anger, or resentment, prove also powerfully stimulant to the system.

It may be proper here to remark, that although all matter in itself is asserted to be more or less possessed of a stimulant power*, yet some of the sensations of the mind seem to have an effect on the body, the reverse of that produced by stimulant powers; such as the sensations of shame, fear in a certain degree, grief, &c. and directly produce a state of accumulated irritability.

* Some articles of the *Materia Medica*, may also ultimately prove an exception to this; such as many of the neutral salts, which, though their first action is locally stimulant to the intestines, produce, by evacuation, that state of the muscular fibre, the reverse of that which stimulant matter produces, an accumulation of irritability.

Having taken a general view of different stimulant powers, to whose operation the human body is constantly subject, and of those, to which it is occasionally exposed; I will next endeavour to divide these stimulant powers into five classes, or genera:

1. Those stimulants, which have a *chemical* effect on the system, and which, at the same time, neither afford nutriment to the body, nor much exhaust irritability; such as the atmospheric air, water, some of the vegetable acids, and *oxygen* in its various combinations.

2. Those, which have a *chemical* effect on the system, which, at the same time, afford some nutriment to the body, and which also exhaust irritability, or are highly stimulant; such as different vegetable matter, after having undergone the vinous fermentation.

3. Those, which have not any evident

D

chemical

chemical effect on the system, nor yet afford much nutriment to the body, but which quickly exhaust irritability, or are highly stimulant; such as spirit of wine, in its different degrees of strength; some articles of the Materia Medica, such as vitriolic æther, and opium, in large doses; and violent passions of the mind, violent exercise, &c.

4. Those, which have not any evident *chemical* effect on the system, which do not quickly nor violently exhaust irritability, and yet afford a great degree of nutriment to the body, and stimulus to the mind; such as different kinds of mucilaginous, farinaceous, and animal matter; agreeable and moderate passions, opium in small quantities, camphor, &c.

5. Those, which have not any evident *chemical* effect on the system, which do not quickly nor violently exhaust irritability, and which also do not afford much nutriment to the body, and, at the same time,
 have

have tonic effects on the muscular fibre; such as the cortex peruvianus, ferrum in its different preparations, &c.

Though the five preceding classes comprehend every stimulus with which we are acquainted; yet experience renders it necessary to form a separate class, whose action seems entirely confined to the nervous system; these chiefly consist of the stimulants included in the 3d class, when exhibited in small doses, or when those of the mind are excited in a moderate degree; nothing else can explain the pleasant effects small doses of opium produce in *Typhus*, but that its action is entirely confined to the nervous system; we see a state frequently occur in *Typhus*, when the muscular action, or the irritability, is much exhausted, and not easily acted upon by stimulants; and yet, at the same time, a small dose of opium has an evident effect on the nervous system.

As there is no general rule without some exceptions, as there is no theory, even truth itself, which "is armed at all points," and which does not admit of some variety or exception, so, on this occasion, it must be anticipated, that the nervous system does not *always* suffer an equal exhaustion of its power, with that of the muscular fibre, and may, therefore, apparently be comparatively accumulated, when the irritability is exhausted. Perhaps this fact may be explained by an observation, which, in this place, it seems proper to mention, that some bodies from the earliest infancy, do not only differ, with respect to the proportional powers of excitability of the nervous, and of irritability of the muscular fibre; but also with respect to the degree of both these powers, compared with those of another body; and therefore, in some, the state of healthy irritability, which I have supposed to be 50*, will, in some bodies, be at 60, and in some, at

40;

* See Scale B.

40; and must be considered accordingly in the lessened or encreased ratio.

Having taken a concise view of the different solids of the human body, of different stimulant powers which act on these solids; I will next proceed to give an explanation of the Scales, A. and B.

The human fœtus in utero, about the conclusion of the ninth month after impregnation, is a compound of matter so organized, as to be capable of being acted upon by various stimuli, necessary to the continuance of life; and immediately on its evolution, the first stimulus it receives, (exclusive of the additional circulating blood) is a quantity of atmospheric air into the lungs; this, with the addition of some milk, or mild food, taken into the stomach, is all the stimulus it seems capable of receiving, at this period, consistent with life and health; the external senses cannot bear any strong action on them, particularly
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the eye, which cannot bear the stimulus of light. In this state then, there is evidently the greatest accumulation of irritability; the smallest stimulus whatever, even that of air, and the mildest food, so readily acts upon it, as to produce almost constant sleep; with every application of stimuli therefore, the irritability is easily exhausted, and the state of sleep is the immediate effect; and notwithstanding the state of sleep tends always to restore the irritability of the system exhausted by stimuli, yet that it never entirely restores the exhausted irritability, will appear sufficiently evident, when it is considered, that the degree of accumulation of irritability, is less and less every day, from infancy to puberty, which is proved by the known circumstance of the same stimulants having a lesser effect every day; as well as by the encreasing power of bearing the action of stronger stimuli; and this daily and rapid effect of the applica-
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tion of the mildest stimuli, in lessening the accumulation of irritability, from infancy to puberty, seems only consistent with health and strength.

From the age of puberty to that of 35 years of age, the same effect takes place, as may be proved by the same observations, only in a degree less rapid. At this period of life, viz. about 35 years of age, it appears that there exists, as it were, a just and healthy equilibrium, between the powers of the ordinary stimulants, and the power of irritability in the muscular fibre; yet at the same time, as the continued application of the ordinary stimuli, is absolutely necessary to life and health; so the daily effects of these, is a small degree of exhaustion of irritability, and the state of healthy sleep. But again, according to the organization of our bodies, though sleep restores the healthy state of irritability in a certain degree, yet it seems never to restore actually
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the former state; a small degree of exhaustion of irritability taking place every year, and this too only consistent with health, as the state which is healthy at 15, will be disease at 50 years of age. This gradual change, consequently, not only indicates the power of bearing, but also the necessity of the application of stronger stimuli, as we advance in life, until, at last, that state takes place, which we call old age, which is little affected by the ordinary, and scarce sensible of the stronger, stimuli; and as these gradually cease to make the impressions necessary to the continuance of life, the death of old age must take place. And this event perhaps would seldom be extended to the period commonly supposed*, if the same mild, ordinary, unvaried stimuli,

* The human body, being accustomed for many ages to luxury and intemperance, has so degenerated from the state in which it must have been originally formed, that it requires now more than the power of the milder stimuli, to protract life to the common period of old age.

were constantly applied, but rather at an earlier period, unless some additional and stronger stimuli, as are usually and generally applied in declining life, did not act on the state of exhausted irritability, no longer capable of being acted upon by ordinary stimuli.

Thus I have endeavoured to shew that the different states of irritability, as marked in the Scale A, attend the different periods of life from infancy to old age; and also, that these different states of irritability are produced by the application and action of stimulant powers.

From these views it easily follows, that, if a given quantity of mild and moderate stimuli can produce, in a given number of years, the ultimate effect, death; so, the sudden application and action of violent and powerful stimuli, such as vinous and spirituous liquors in large quantities; and the contagion of the plague, *Typhus*, &c.

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will produce the same effect, in a very short space of time.

As it has also been shewn, that the application of mild stimuli, to a certain degree, is necessary to the continuance of health and life, so it will as easily be understood, that the want or abstraction of such stimuli, for a length of time, will not only produce death, but must also occasion an intervening state of irritability, the *reverse* of that produced by the *application* of stimuli, either ordinary or powerful; these two different states I have accordingly pointed out in the Scale. The symptoms and effects of the accumulated state I will more particularly explain, when sleep, one effect of that state, is considered. For which purpose I have sketched another Scale, B; it is drawn applicable to that period of life, about 35, when in general the equilibrium between the *venous* and *arterial* system takes place, and the balance between the waste
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and growth of the body, and the aliment consumed, is equal, and when it is supposed, the degree of irritability, consistent with health, is at 50 in the Scale.

At every period of life, sleep seems to be the effect, either of the exhaustion, or accumulation, of the excitability of the nervous, and of the irritability of the muscular fibre, produced by the application, or abstraction, of stimuli. Of sleep, the effect of the application of stimuli, there appears to be two different states; the one healthy, the other morbid; healthy sleep is the natural effect of the application of mild and moderate stimuli; morbid sleep, the effect of very violent stimuli, long, or suddenly, applied; it seems also a law in the animal œconomy, that the state of sleep does not take place, when the irritability is *much* exhausted by violent stimuli, whether applied to the body, or to the mind. Opium in large doses is an instance of the one, and violent pas-

sions of the other, as well as the contagion of *Pestis*, *Typhus*, and other diseases, which latterly produce watchfulness and delirium.

Common or ordinary sleep, produced by the application and action of stimuli, from what has been said, seems therefore to be a state, the result of a law of the animal œconomy, which takes place in order to remove the effects of stimuli applied, and to restore, as much as possible, the healthy state of the irritability and excitability of the system; as during that state, all stimuli cease to act, all objects cease to make any impression; while the atmospheric air is the only foreign power, which then continues to be applied, at once carrying off what is morbid from the lungs, and assisting, with the food taken into the stomach, to stimulate the heart and arteries to carry on the circulation, and to supply the waste occasioned by the common secretions and excretions of the day.

Sleep,

Sleep, both healthy and morbid, I have yet only considered as the effect of irritability and excitability exhausted, to certain degrees; but it will also easily appear, that sleep is often the effect of *accumulated* irritability, and in general in the same ratio, as the former, in the manner I have pointed out in the Scale.

The existence of whatever daily occurs to the observation of all, it is surely unnecessary to prove, but not so, to endeavour to explain. It seems equally a law of the animal œconomy, that the state of sleep shall take place, when the ordinary stimuli, those of air and light always excepted, have been for a short time withheld, as well as when they have been applied. Though sleep takes place under both these circumstances, it is self-obvious, that the states themselves must be exactly contrary. The state of sleep to which I allude, takes place, generally, I may almost say, inevitably, in
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every person, who abstains from food for 24 hours; and also at the same time, avoids the application of any stimulus to the body, such as exercise, such as that of agreeable conversation, or of books. This sleep again we see take place in those, who have, from want of food, been obliged to abstain from it, for a greater length of time, notwithstanding the application of the stimulus of exercise to the body, or conversation to the mind; and such unfortunate persons as have died of hunger, generally expire in a state of sleep. This is well known to those, who have been shipwrecked, and have experienced want of proper food, for a considerable length of time. Of every degree of such a state of sleep, the case of Capt. Bligh and his company in the *Bounty's* Launch, is a striking, and fair example. In them, the irritability of the system was, at first, no more accumulated, than to that degree, which produced sleep,

sleep, that refreshed them ; but soon afterwards, the continued abstraction of a sufficient portion of food, together with the effects of cold and moisture, produced such a degree of accumulated irritability, that they did not enjoy much sleep ; indeed, at this period, Capt. Bligh says, he “ almost lived without it.” That the state of Capt. Bligh, and his company, was, at this time, *that* of accumulated irritability, is proved, by *one* tea-spoonful of rum producing effects, nearly equal to those, which it would require *twenty* to produce, in their usual healthy state. But it is only when the accumulation of irritability takes place in a very great degree, such as I have supposed, and pointed out in the Scale B, that apoplectic sleep, or sleep terminating in death, ensues ; such is the common effect of extreme cold to travellers in winter : such Capt. Bligh, at last, experienced in his men, when they had long suffered the abstraction

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tion of proper stimuli.—Capt. Bligh has these words :

“ *Monday, 8th June.* This day the sea ran very high, and we were continually wet, suffering much cold in the night.

“ Amongst most of the men I observed more than a common inclination to sleep, which seemed to indicate that nature was almost exhausted.

“ *June 11th.* Extreme weakness, swelled legs, hollow and ghastly countenances, great propensity to sleep, with an apparent debility of understanding, seemed to me melancholy truths of their approaching dissolution.”

That Capt. Bligh himself did not suffer such effects from the same causes, will easily be explained, when we consider, that he enjoyed the influence of many stimuli, to which his men were comparatively strangers. I mean the stimulus of self-approbation,

tion, and that he was the means, through Providence, of saving the lives of so many persons, and all the stimuli, induced by the hopes, and the prospect of approaching pleasure and honour, in his native country.

In a less accumulated state, than this I have just described, sleep seems capable of diminishing the accumulation of irritability, and, consequently, more or less restores the healthy state; and this is proved by many observations, and by one in particular, that sleep, in such states, supplies the want of food; the appetite for it, which was experienced before sleep, not being felt immediately after sleep; indeed there are instances recorded of persons sleeping for many days, and even months, and at the same time, neither taking, nor feeling the want of food. Each night is a proof of the same, every one in the morning, having less appetite for food, than they would

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have felt, had they been in a state of health, and waking during the night.

From the whole of these observations, it will appear, that a certain degree of accumulated irritability, may produce healthy sleep; a greater degree, watchfulness, or morbid sleep, according to the causes; and a greater degree, that state, which sleep is no longer able to restore to health, and which terminates in death.

It is then, I think, sufficiently evident, that at all periods of life, the abstraction of stimuli, always supposing that of respiration to continue, will, in exact proportion to such abstraction, and to the state of irritability present, render the body more susceptible of stimuli, or will accumulate irritability; that in infancy, when the irritability is already much accumulated, any abstraction of stimuli cannot be continued long, without exhausting it entirely, or producing death. That in proportion to
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the advance of age, till the period 35, such abstraction can be endured with less danger to life; this period then of 35, will be the strongest in general in human life; the degree of irritability is then, at the farthest, from each extreme of death; the system being capable of a greater accumulation, as well as of a greater exhaustion, than at any other age. That after this period, 35, it appears, that the system requires the application of stimuli, in a greater degree, to preserve the state of health; which state must, from what has been said, be about one degree higher, or more exhausted every year, so that the degree 50, which is supposed to be the healthy state at 35, will be a state of accumulation, or 10 degrees below health at 45, or 50 years of age, and so on in the same ratio; the point of death, being 10 degrees higher from the extreme of accumulation, it being impossible to produce

the degree of accumulation, which is in infancy, in one of 50 years of age.

Another general conclusion may also be drawn from what has been said; that the application of stimuli must always be varied with respect to quantity, according to the different states of irritability.—When it is much accumulated, as in infancy, or in a more advanced age, occasioned by the abstraction of stimuli, the most gentle and mild stimuli must be first applied, and gradually increased; but when, on the contrary, the irritability is much exhausted, more powerful stimuli, and in greater quantity, must be applied. In proof of the first, we have only to consider, the common state of any animal, almost dead with want of food; if to the animal, in this state, much food be hastily given, it generally dies; but if it be carefully, and gradually applied, the animal generally recovers the powers of life. Persons frozen with cold, or apparently dead
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by drowning, are all instances of the same; to these, it is now known, the most natural and mild stimuli must be first applied.—To bodies frozen, the application of snow with friction, is more salutary than any artificial warmth; if such be applied, it is well known, Sphacelus ensues.

Instances in proof of the latter, or that the opposite means may be used, when the irritability is exhausted, are also common. We can apply, not only with safety, but with the best effects, ardent spirits, to a part burned or scalded; but such application, to a body frozen, induces gangrene. We can apply cantharides, and large doses of opium, to a person in a state of exhausted irritability in *Typhus*; but we cannot, with safety, apply these stimulants to an infant. To the body of a person apparently dead by drowning, which is then in a state of accumulated irritability, produced by the total abstraction of every stimulus, the
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most gentle and natural heat is first applied, and the common stimulus of respiration is endeavoured to be restored: when that can be effected, such a change takes place in the state of irritability, according to the age of the person, that more powerful stimulants can be then safely employed.

When we consider these two opposite states, and find that both cold and heat will occasion inflammation; may not there be two different states of inflammation, and each consequently require opposite treatment? Of this I will only name one instance: There is a species of ophthalmia, which requires blood-letting, and the antiphlogistic regimen; and there is another, such as scrofulous ophthalmia, that requires stimulant applications, such as mercury, and even ardent spirits, diluted with water.

Before I quit this part of the subject, I may take notice of a peculiar state of the system, called *Hætic*. Every circumstance
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proves this state, to be that of accumulated irritability; the least stimulus, whether applied to the mind, or to the body, having considerable effects on those affected with *Hectic*. Such a state of the system, at first sight, would seem easily changed to that of health, by the application of proper stimulants; but in this peculiar situation of the body, there always exists some cause, absorption of pus, or injured organization of some vital organ, or violent affections of the mind, which so constantly, and rapidly, accumulate irritability; together with the appetite being much impaired, that no healthy stimulus can be applied in sufficient quantity, to prevent the daily encreasing accumulation, which soon arrives at that point, when all the organs necessary to the continuance of life, can no longer perform their functions, and cease to act.

Having now pointed out different states of the irritability of the muscular fibre, and
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consequently, of the excitability of the nervous power, as produced by the application and abstraction of stimulant powers, I will next make a very few remarks on the different existing quantities of *carbone* and *hydrogen*, which I have supposed to correspond with the different states of irritability, in Scale B. In this I have placed *carbone* and *hydrogen* in a state of accumulation, in proportion to the state of irritability, and that they both accumulate equally, according to the ratio of their existing proportions in the opposite states of irritability. The data, on which this supposition is founded, I will endeavour to enumerate, which, I hope, will at least prove, that if there is not a positive accumulation of *carbone* and *hydrogen*, in the extreme of each of these states, there is a comparative accumulation, or an over-proportion of both, to the proportion of *oxygen*, necessary to preserve the equilibrium of health. The analogies

lysis of animal substances, proves the existence of *carbone* and *hydrogen*, in considerable proportions, in all animal matter; and the circumstance of bodies, which have been interred, and afterwards found, in the state of animal fat*, proves not only the same, but also, that *carbone* and *hydrogen* remain, after the *oxygen* has entirely disappeared, as animal fat is known to consist of 21 parts of *hydrogen*, with 79 parts of *carbone*; and the reason, that every animal body does not terminate in this state after death, and when it is no longer under the action of *oxygen*, Lavoisier has shewn, to be occasioned by the presence of *azote*, which, in these instances, where animal fat was formed, had been, by a process, not yet sufficiently known, entirely disengaged.

That the existence of *oxygen* in the

* "Rapport sur les Exhumations du Cimetiere et de l'Eglise des Saints Innocens, &c." Par M. Thouret. Med. Facts and Observations, Vol. 1, page 186.—Lavoisier's Elements of Chemistry.

healthy living body, and its absence, in a certain degree, whenever a putrescent state takes place, and that this state begins, when the healthy equilibrium of *oxygen*, with *carbone* and *hydrogen*, is destroyed, seems more than probable, from a variety of observations.

It has been already observed, that *oxygen* is received into the lungs in respiration; and Lavoisier has shewn, that the red globules of the blood contain a very large quantity of *oxygen*; whose experiments also, with those of Mr Hewson, Dr Priestley, and others, prove, that the blood receives its florid colour, in passing through the lungs; that the blood undergoes a remarkable change of colour, when circulating in a living animal; that the vivid arterial blood, in its passage through the extreme branches to the venous system, acquires a deep livid hue, and again receives its florid colour in the lungs. Mr Hewson
has

has also perceived the blood, in the right auricle, much darker, than that, in the left; and it is very well known, that blood drawn from a vein, and allowed to coagulate, in atmospherical air, assumes, on its upper surface, a more florid colour, than that, of its under surface; but if the under surface is exposed to the air, it also soon loses its dark colour, and becomes more florid. The experiments of the same persons have also proved, that the blood is red only in proportion, as it is in contact with dephlogisticated air, or the *oxygen gas* of Lavoisier more properly; and that it loses its redness, when exposed only to *hydrogen*, or *azotic gas*, or the *carbonic acid*, or to any unrespirable air, or even in the exhausted receiver of an air-pump: and that, on the contrary, it receives its red colour, when again placed in contact with *oxygen gas*, or with atmospherical air; and that this restoration of the red colour, is constantly at-

tended by a diminution in the volume of the air. From all these observations, it may safely be concluded, that in exact proportion to the encrease of the dark colour of the blood, is the deficiency of *oxygen*, and the encrease of the tendency to a putrescent state; and that *oxygen* is the general and only corrector of such a tendency, which is ever present, even in the healthy body, and very rapid in some diseases, such as *Pestis* and *Typhus*.

Having now given a concise view of the observations on which I was induced to place the existence of *carbone* and *hydrogen*, according to the degrees in the Scale B*, I will next proceed to apply the result of the whole, to the explanation of the causes and cure, and cause of death, in *Typhus*.

* It will be of course understood, that the *quantities*, or even the *proportions*, given in the Scale, are by no means intended as *positive*—to estimate the *quantities*, appears an unnecessary, and perhaps, an impossible, task; and the proportions, therefore, are only intended to be comparative.

I consider it unnecessary to make any remarks on the different states of arterial and venous *plethora*, which I have marked in Scale A, as they have been long established in physiology; I have only noticed them, as they seemed connected with the subject of irritability, to render the Scale more complete.

Having left one, I now enter into another extensive field of observation and argument, on the causes which produce, on the immediate or proximate cause, and on the cure of *Typhus*; before I attempt the explanation of either of these, it is necessary that I should first endeavour to shew, that *Typhus* is, in every view, a distinct genus from any other fever*; and that it is very

* On this subject, I have an object strongly at heart, which is, to banish the idea of all fevers being of the same genus, and of each being only species and varieties; and also that of the *typho*, or continued fever, arising from the same cause, as that of the intermittent; and I hope, at some future period, to be able to accomplish this wish.

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properly considered so, will, I think, be easily proved, by taking into consideration, the definition of *Typhus*, as given by Dr Cullen :

“Morbis contagiosus ; calor parum auctus ; pulsus parvus, debilis, plerumque frequens ; urina parum mutata ; sensorii functiones plurimum turbatae ; vires multum imminutae.”

Typhus being a contagious fever, is alone sufficient, to induce every physician to consider it a distinct genus from any other, as no other fever, whether intermittent, remittent, or continued, has this characteristic, except *Pestis*, which seems to be a violent species of *Typhus*, or the *Typhus gravior*, of Dr Cullen*.

As the *Synocha* of Dr Cullen is the fever,

* Many of the exanthemata are contagious, but such cannot be opposed here with any propriety.

from which *Typhus* is supposed to be improperly considered, as a distinct genus, and as, by some, even the existence of *Synocha* has been doubted; with this fever, therefore, I will draw a parallel, with a view, not only of proving *Typhus* a distinct genus, but also, the existence of such a fever, as the *Synocha* of Dr Cullen.

Typhus, as has been already taken notice of, is a contagious disease; *Synocha* is never contagious; in *Typhus*, “calor parum auctus,” is perceived; in *Synocha*, “calor plurimum auctus;” in *Typhus*, “pulsus parvus, debilis, plerumque frequens;” in *Synocha*, “pulsus frequens, validus, et durus;” in *Typhus*, “urina parum mutata;” in *Synocha*, “urina rubra,” (et parca, might be added); in *Typhus*, “sensorii functiones plurimum turbatae, vires multum imminutæ;” in *Synocha*, “sensorii functiones parum turbatae.”

The striking contrast of these symptoms, and their peculiarity, is, I think, sufficient

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to prove, the propriety of considering *Typhus*, a distinct and separate genus from *Synocha*, and from any other fever.

With respect to the existence of such an idiopathic fever as *Synocha*, I will only say, that, independent of the experience of Dr Cullen, and others, who have assured me, they have frequently seen it; I can assert, that I have, more than once, seen a fever, exactly consonant to the definition of the genus *Synocha* of Dr Cullen, and of the *idiopathic* character of fever. It may be objected, to the parallel I have drawn, that both the definitions are given by an author, who has placed, in his nosology, another genus of fever, differing from both *Synocha* and *Typhus*, and yet combined of both: But, I believe, most physicians now allow, that the *Synochus* of Dr Cullen is a genus entirely superfluous; I have been informed, that Dr Cullen himself doubted the propriety of establishing such a genus; but

but, being a clear nosologist, he was willing to give his pupils every form of fever, which he had seen; that the knowledge might check the ardor of the young, and regulate the practice of the incautious, and inexperienced. From every observation I have made, among a very great number of patients, I have ever had reason to believe, that the difference in the habit of body, was the only cause of *Typhus*, sometimes immediately assuming all the symptoms peculiar to itself, and sometimes of being preceded by some symptoms of *Synocha*. To exemplify this, we need only suppose, (independent of the difference of temperaments) that, if a strong and robust man is seized with the contagion of *Typhus*, the symptoms, at first exhibited, will agree very much with those of *Synocha*, and be very different from those first exhibited in a body weak and reduced.

The remote causes of *Typhus* are those,

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which pre-dispose the body to the disease, and those which excite it; of the latter, contagion is allowed to be a common cause. Though *Typhus* is considered as a disease produced by contagion, yet this contagion, like many others, may be generated in the body, the effect of the concurrence of certain pre-disposing, and exciting causes, independent of foreign contagion; this, I think, cannot admit of any doubt; some of these causes I will shortly enumerate.

The more the irritability is accumulated by any of the causes mentioned in Scale B, by the abstraction of the ordinary and proper stimuli of food, by depressing passions, or by disease, the more easily it will be affected by contagion: all those causes therefore, may be considered as pre-disposing causes of *Typhus*, and the state of accumulated irritability, the pre-disponent state, being most liable to the action of contagion, or with the addition of other exciting causes,

causes, generating the disease. Of these, the principal are, impure air, want of cleanliness, and of exercise, and cold with moisture.

The instances we have of these causes producing *Typhus*, are too numerous to mention, particularly that of impure air, to which alone the fever can be attributed in jails, hospitals, ships, &c. Impure air, or air containing an over-proportion of *azote*, or of any unrespirable air, and consequently, not sufficient *oxygen* to carry off the accumulating *carbone* of the system, may easily be understood to act as an exciting cause. The over-proportioned *azote* (the equilibrium being destroyed by the deficiency of *oxygen*) may combine with the *hydrogen* of the system, and produce a morbid volatile alkali; or the want of cleanliness alone, by generating, or accumulating the *hydrogen* and *carbone* of the system, and thereby destroying the equilibrium, and also by exhausting the *oxygen* of the surrounding at-

mosphere, may ultimately produce the same effects, and the fever called *Typhus*, be produced.

Whether then we take a view of the effects, which these exciting causes, or which the contagion, when already generated and applied, produces on the body, we cannot hesitate to pronounce all of them to be highly stimulant, and that they will quickly exhaust the irritability of the system. The knowledge which we now possess of the powers of *hydrogen* and *carbone*, entirely leaves the result beyond all doubt whatever. From these views, the *Proximate* cause of *Typhus* will be easily understood; an *over-proportion* or *accumulation* of *carbone* and *hydrogen*, and an *exhausted state of irritability*.

From the remarks I have already made, on the effects of *oxygen* on the blood, both in the state of circulation, and when drawn from a vein, and allowed to cool, from the difference of the colour of the returning
blood,

blood, with that, which has just passed through the lungs, and from our knowledge, that the red globules are *oxyids*, and from the similar appearance, which the blood, in a person labouring under *Typhus*, has with the returning venous blood, and from the anxiety in respiration, which they, who labour under *Typhus*, always discover, we can have little doubt, I think, that the morbid accumulation of *carbone* and *hydrogen*, or the deficiency of *oxygen*, is the cause of the symptoms of *Typhus*, the principal of which are, besides those common to *Pyrexia*, universal debility, and a rapid tendency to a putrescent state. *Oxygen* is the universal antiseptic of all Nature; *carbone* and *hydrogen*, are, with *azote*, the putrefactive principles; with the decrease of *oxygen*, will encrease the tendency to putrefaction, and with the encrease of the tendency to putrefaction, will the irritability be exhausted, and symptoms of debility,
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in both body and mind, be progressively evident.

The indications of cure in *Typhus*, easily follow the knowledge of the causes; these are therefore three:

1. To avoid the remote causes.
2. To remove the *Proximate* cause. And
3. To restore the healthy state of the irritability of the system.

The knowledge of the remote causes may enable us to answer the first indication, by every means being taken to avoid them.

The *Proximate* cause, or the accumulation, or over-proportion, of *carbone* and *hydrogen*, can only be removed, as will appear, from all that has preceded, by the application of *oxygen* in sufficient quantity, to correct this morbid accumulation, and to restore the state of healthy equilibrium*.

Oxygen

* It is with much pleasure that I have perceived an ingenious

Oxygen taken into the stomach, in the combined state of many different acids, may answer this intention, but in the state of the acid of *nitre*, combined with *potash*, seems to me the most easy, and most powerful form of exhibiting it; the process for obtaining pure *oxygen*, in the state of *gas*, in order to throw it into the system, by the lungs, would be not only tedious, but difficult. In the state therefore, of the neutral salt, *nitre*, it appears to me at present, from every observation, to be the most effectual mode of throwing it into the system. Mr Wood, surgeon, in Berwick, has used this medicine in this fever, invariably during a long and extensive practice. In a letter, which I lately received, he uses these words: " I never kept any minutes of the number

nious attempt by Dr Crawford, to apply the result of our improved chemical knowledge, to pathological purposes. Vid. Phil. Transf. of the Royal Society of London, vol. lxxx. year 1790, Part II. and Medical Facts and Observations, vol. ii. page 132.

of patients to whom I gave *nitre* in fever, but this I am sure of, that I have given it in fever for more than thirty years, with incredible success, and in that time to a very great number of patients, in every rank, especially among the lower ranks, and to a great number of soldiers and sailors. If the fever did not come to a crisis before the 13th day, I generally gave Dr James's Powder, beginning with five grains to a grown person, but I had not often occasion to give it; if you try *nitre*, you will find it a wonderful medicine in fever; give it three or four times a day."

I have lately exhibited *nitre* in the form of solution, to 15 patients, labouring under *Typhus*; many of whom, when I first saw them, had all the symptoms, in a very violent degree; I did not give to any of these, any antimonial, but I immediately exhibited the solution of *nitre*; in two or three of them, the pulse, which was from

100 to 130, was diminished in frequency, and increased in strength, before the expiration of the first 24 hours; the change, indeed, was often so great, that I rather supposed it to be the effect of some other cause, than of the operation of the solution; to convince myself of this, I gave it to two patients, whose pulses were from 120 to 130, and found, on my visiting them the next day, both reduced below 100; all of the number I mention, (and indeed I have not lost a patient in *Typhus*, since I have given the *nitrous* solution*) recovered before the 10th day, some on the 5th, 6th, and 7th. I shall certainly wait for the result of farther experience, before I eradicate from

* The following was the formula commonly used:

R. Nitri Purificati drachmam unam cum semisse,
 Aquæ Distillatæ uncias septem;
 Solve salem, et adde
 Syrupi Sacchari albi unciam unam,
 Tincturæ Lavendulæ Comp. drachmas duas; misce.
 Capiantur una, vel duæ uncia, secunda, vel tertia, quaque
 hora.

my mind the doctrine of *critical days*, or that, of the continued succession of paroxysms, in *Typhus*, or *Synocha*; but, at the same time, from the view I at present have of the *Proximate* cause of *Typhus*, and from the effect of *oxygen*, in entirely banishing every febrile symptom in a few days, I cannot but feel a doubt of any good foundation for such doctrines. If the *Proximate* cause, which I have given, is true, it necessarily follows, that the disease must disappear, the moment the cause is removed, whether in the first hour, or on the 20th day; those diurnal revolutions, however, which are perceived to take place, in a state of health, may easily be supposed to be more apparent in the state of fever; I mean the states of remission, and exacerbation.

The above result of the practice recommended in *Typhus*, was written in the month of July, 1792; between which period

riod, and the first of December, I have tried the *nitrous* solution, to 35 patients, who were affected with all the marked symptoms of *Typhus*, in a violent degree, and to 13, who were affected in a less violent degree, *all of whom recovered*, and the greatest number, in less than ten days.

Previous to the practice which I now pursue, I never visited a patient in *Typhus*, without experiencing some of those feelings, which the physician is obliged to suffer, when he visits a patient labouring under confirmed *Phthisis*. I could not but feel much despair in the success of a method of cure, which has so repeatedly failed; besides these feelings, having imbibed the idea of the necessity of the fever continuing for 14, or some *certain* number of days, I sat down before it, as it were, to commence a siege, and by the force of example, I steadily believed in this theory, and persevered in the practice, until the

early sun-shine of returning health banished from my mind the error of the one, and the *strongest of all human convictions* seemed to prove the inefficacy of the other.

On this subject, and in this place, let me do every homage to the *judgment*, as well as to the *memory*, of the Man, who *was* (alas!) universally acknowledged to be the first Philanthropist of the age; the present practice, in the *Typhus* of the gaols, did not escape his all-attentive eye*. “No *effectual* reform,” he says, “will be made in our prisons, till the root of these evils” (immorality in its various forms) “be cut off, which, from the closest observation, I am convinced is *the vice of drunkenness*. To this end, restraints must be laid, which will, to many, I am sensible, appear harsh and severe; but in this matter, there is no *medium*; any indulgence to particular classes of

* See the “Account of the principal Lazarettoes in Europe,”
by JOHN HOWARD.

prisoners,

prisoners, will *ruin* the *whole* design. It will, in my idea, be absolutely necessary, to prohibit the introduction of any kind of liquor, except milk, whey, butter-milk, or water, into gaols.—With regard to the health and real comfort of prisoners, I am persuaded, they would be promoted by such a prohibition.” And, in a note, he adds, “ If Gentlemen of the Faculty, and others, still object to the exclusion of all fermented liquors from gaols, under the idea, that their use is in some measure necessary, as *antiseptics*, I would desire them to consider, that by the proposed dietary, prisoners are to have a warm dish, chiefly of vegetables, twice a day;—and that of female prisoners, who in general drink very little beer, a small proportion, compared with the men, die in prison. I am sensible my ideas are contrary to the present *fashionable* mode of prescription, which, I am persuaded, *confirms* the habit of drinking

ing strong liquors, both in town and country; but may I not hope, that the *opinions* of Medical Gentlemen will, in time, alter as *much* on this subject, as I have seen in their treatment of the Small-pox?"

I may perhaps take notice in this part, of other remedies recommended in *Typhus*. Fixed air has been said to have been used with success; it will be obvious, however, that the tonic, or antiseptic powers of fixed air, can only be derived from the *oxygen* of this acid; the *charcoal* cannot possess any such power, it being composed by analysis and synthesis, of 72 parts of *oxygen*, with 28 of *charcoal*.

Many neutral salts likewise, which have been found useful in *Typhus*, can only have their good effects from the *oxygen*, with which they are in a state of combination. Thus *alum* owes its powers to the *oxygen* of the sulphuric acid, which it contains in great quantity.

In order to explain every mystery, and convince those who may be attached to an old practice; I will beg leave to enquire, if, in those patients who have recovered from *Typhus*, by the use of the bark, as it may have been supposed they have, any *credit* was ever given to the acid in alum, or to the vegetable acids of the orange, or the lemon, or of other fruits, which were at the same time exhibited with the bark; or to the *local state* of the surrounding atmosphere?

The third indication of cure, which I have named, is to restore the healthy state of the irritability of the system; perhaps this indication in general may be altogether superfluous, as the exhausted state of irritability in *Typhus*, is the effect of the stimulant action of accumulated *carbone* and *hydrogen*, and consequently, when the equilibrium is restored, by the application of *oxygen*, the irritability will, by the powers of the animal œconomy, be naturally restored to the state of health.

But

But when, on the contrary, the morbid effects of accumulated *carbone* and *hydrogen* continue to encrease, from the continuance of their accumulation, the irritability will be at last so far exhausted, as to produce the state of death.

But, from this I would not conclude, that the accumulation of *carbone* and *hydrogen*, though it is the *Proximate* cause of *Typhus*, to be also the cause of death in this fever; such accumulation I would only consider as the cause of the exhausted irritability and excitability, and the *irritability* and *excitability exhausted*, to be the *immediate* cause of death in *Typhus*.

A numerous class of stimulants, such as wine, brandy, opium, &c. have been given in *Typhus*, with the view* of preserving and

* In another light also, have powerful stimulants been promiscuously given, in every case of exhausted irritability, by the rigid followers of the late Dr Brown, with the idea, (the most common rock on which so many have foundered) that there are only *two states* of the body, and that *that* of exhausted irritability

and restoring the healthy state of the irritability of the system; but it must appear immediately obvious, from what has been said on the effects of the application of *such* stimulants in large quantities, that, although their immediate action is to give to the system a degree of energy and excitement, their ultimate effects tend to exhaust that very power, which is wished to be preserved and restored. Therefore, as soon as the effects of excitement produced by one dose of such stimulants are past, another dose is immediately necessary; but then it always happens, that the second dose must be stronger than the first, as, the excitability being more exhausted, an increased dose is requisite to produce the state of

irritability is to be cured, whatever the disease, by the use of stimulants. But it should be considered, that, although every remote cause will produce one or other of these two states of irritability, yet the same cure is not always applicable, as the causes are *different*, and consequently, the remedies must likewise be so; and besides, the state of irritability is generally only an effect, not a cause; only a consequence, not the disease.

excitement, which the first dose produced; the third dose again, for the same reason, must also be encreased, and the conclusion, of course, must be total exhaustion of irritability, or the state of death, as certainly, as if the same stimulants were poured into the body, as quickly and regularly, in a state of the most sound health.

From the whole of these considerations then, it will appear, that those classes of stimulants can only be continued with success in *Typhus*, which have a salutary chemical effect on the system, whose action is not followed by any violent exhaustion of excitability, or irritability; and those, which at the same time, afford some degree of nutriment to the body. The 1st and 4th classes* then, will be more particularly adapted to the cure of *Typhus*. Of these, *oxygen* is the first; and next, those which afford some nutriment to the body, which

See page 25.

are

are in a small degree stimulant, and do not much exhaust the irritability; of these may principally be mentioned, the strong juices of different kinds of animal matter obtained by decoction in water, and particularly of beef, venison, mutton, and the nutritive juices of several young animals, obtained in the same manner.

In the beginning of the fever, and while the senses are capable of sensation and perception, the influence of many of the stimuli of the mind* may have the most salutary effects; particularly, Hope, and confidence in recovery; agreeable objects also presented to the external senses, and pleasant ideas excited by every usual means, will tend, in no small degree, to contribute to this part of the cure of *Typhus*.

Though I have endeavoured to shew, that only the particular classes of stimulants which I have mentioned, viz. 1st and 4th,

* See "A Dissertation on the Influence of the Passions upon Disorders of the Body," by W. FALCONER, M. D.

can be applied with success in *Typhus*, and that the *continued* use of any of the stimulants of the other classes, cannot be defended as a safe practice; at the same time, it must be allowed, that an *occasional* use of them to preserve the living principle, until more healthy stimulants can be employed, may be attended with the highest advantage, when the irritability is so much exhausted, and such extreme debility has taken place, that only the most powerful stimulants can have any effect; of these I am inclined to give the preference to the stimulus of *cantharides*, applied in the form of plaisters, to the external surface of different parts of the body; the application of which alone, or sometimes preceded by the *camphorated mixture* taken internally, and alternately with the *nitrous* solution, I have found to succeed to my utmost wishes in cases of the most extreme debility; and I

used

used this practice to many of the patients in the number I formerly mentioned.

Some *tonics* also may prove assistant to answer this indication; such as *Ferrum* in its different preparations, or dissolved in water, which has been previously saturated with the *carbonic acid*. As a *tonic*, or perhaps with more propriety, as a chemical stimulant, *Vinum Lusitanum*, diluted with water, may be occasionally used with desirable effects. The use of this wine, when symptoms of great debility shall indicate, or when other stimulants are disagreeable, may also be a means of preserving the living principle, until the action of the more mild and natural stimulants can take place, in a sufficient degree.

When it is considered then, what must be acknowledged by every candid Practitioner in Physic, that the present practice of exhibiting indefinite quantities of bark, and of violent stimulants, for the cure of *Typhus*,

is

is often unsuccessful, and not yet explained on any theoretical principles; and that the practice, founded on the theory here pointed out, has been, in all the trials hitherto made, successful, even to a degree higher, than the most sanguine Theorist could expect; may not the following corollaries be safely drawn?

That the present common and general method of cure in *Typhus*, is very precarious, and is founded more on *empirical* than *dogmatical* principles.

That the success of the method of cure, now recommended, is, at least, equal with, if not greater than, the method commonly followed; and, consequently, equally preferable, and entitled to cool attention and impartial trial.

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Page 1. Preface, for *Verfaur*, read *Verschuir*.

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E R R A T U M

Page 1. Preface, for Verlang, read Verlehen.

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SCALE				A.			
Death.	Old Age.	Advanced Life.	Years of Life.	Death.	Old Age.	Advanced Life.	Years of Life.
100	95	90	85	80	75	70	65
95	90	85	80	75	70	65	60
90	85	80	75	70	65	60	55
85	80	75	70	65	60	55	50
80	75	70	65	60	55	50	45
75	70	65	60	55	50	45	40
70	65	60	55	50	45	40	35
65	60	55	50	45	40	35	30
60	55	50	45	40	35	30	25
55	50	45	40	35	30	25	20
50	45	40	35	30	25	20	15
45	40	35	30	25	20	15	10
40	35	30	25	20	15	10	5
35	30	25	20	15	10	5	0
30	25	20	15	10	5	0	
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10	5	0					
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EQUILIBRIUM.

MEDIO TUTIS.

-SIMUS IBIS.

Venous Plethora.				Arterial Plethora.			
Death.	Old Age.	Advanced Life.	Years of Life.	Death.	Old Age.	Advanced Life.	Years of Life.
100	95	90	85	80	75	70	65
95	90	85	80	75	70	65	60
90	85	80	75	70	65	60	55
85	80	75	70	65	60	55	50
80	75	70	65	60	55	50	45
75	70	65	60	55	50	45	40
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INDIO JULIO

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Legend

S C A L E

B.

	Death—State	Exhausted excitability.	Accumulated hydrogen.	Exhausted oxygen.	Accumulated carbonic.	Exhausted irritability.	State—Death.
Stupor, Delirium, } Insensibility. }	—	10	45	10	50	10	State—Causes. Continued action of the contagion of <i>Pestis, Typhus, Variola, &c.</i> of extreme heat, strong liquors, violent passions, fevere exercise, large dose of opium.
1. Watchfulness, with } Delirium, or, } 2. Apoplectic Sleep. }	—	20	40	20	40	20	State—Causes. 1. Action of the contagion of <i>Pestis, Typhus, Variola, &c.</i> large dose of opium. 2. Extreme heat, strong liquors, violent passions, fevere exercise, &c.
Unnatural, or, } Forced Sleep. }	—	30	35	30	35	30	State—Causes. Application of ordinary stimuli in greater quantity than Nature requires, small quantity of vinous or spirituous liquors, small dose of opium, &c.
Natural Healthy Sleep.	—	40	30	40	30	40	State—Causes. Temperate application of the ordinary stimuli of light, food, moderate exercise, agreeable passions, &c.
ORDINARY HEALTHY STATE.							
Healthy Sleep	—	60	30	40	30	60	State—Causes. Abstraction, for a short time, of the ordinary stimuli of light, food, exercise, agreeable passions, &c.
Unnatural, or, } Unhealthy Sleep. }	—	70	35	30	35	70	State—Causes. Continued abstraction of the ordinary stimuli, &c. diacetes, lethargy, hypochondriasis, hysteria, &c.
1. Watchfulness, with } Delirium, or, } 2. Apoplectic Sleep. }	—	80	40	20	40	80	State—Causes. 1. Continued abstraction of the ordinary stimuli; depressing passions; all the causes of hectic. 2. Absolute and extreme cold, &c.
Stupor, Delirium, } Insensibility. }	—	90	45	10	45	90	State—Causes. Continued abstraction of ordinary stimuli, continued action of depressing passions, of the causes of hectic, of extreme cold.
	Death—State	100	95	5	100	95	State—Death.

OMNES MANET

ALTERUTER FINIS.

100	95	5	100	95
Accumulated irritability.	50	0	Accumulated carbonic.	0
Exhausted oxygen.	50	45	Accumulated hydrogen.	5
Accumulated excitability.	100	95		0

EXPERIMENTS

AND

OBSERVATIONS

RELATIVE TO THE

INFLUENCE LATELY DISCOVERED BY

M. GALVANI

AND

ANIMAL ELECTRICITY.

BY RICHARD D. GOWER.

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