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ON
THE NATURE OF LIFE

RALPH RICHARDSON, M.A., M.D.

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ON
THE NATURE OF LIFE

LONDON
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ON
THE NATURE OF LIFE
AN INTRODUCTORY CHAPTER
TO
PATHOLOGY

BY
RALPH RICHARDSON, M.D. EDIN.

M.A., T. C. DUBLIN.
FELLOW OF THE COLLEGE OF PHYSICIANS OF EDINBURGH.

*"Whoever thinks a faultless work to see
Thinks what ne'er was, nor is, nor e'er shall be."*

SECOND EDITION

LONDON
H. K. LEWIS, 136 GOWER STREET, W.C.
1879

ERRATA.

Page 18 line 19 for *resolved* read *exposed*.
,, 69 ,, 13 for *nor* read *not*.



PREFACE.

To this second edition the title of "The Nature" instead of "The Simplicity of Life" is prefixed, the latter designation having been misunderstood.

The object of this Essay is to explain the Nature of Living Action in all organic Beings, the similarity of such actions in both Health and Disease and their complete analogy with those included in the term gravitation.

In Astronomy and Physics the same laws are applied to the movements of the largest masses in the universe and to the smallest portion of the comparatively small globe which we inhabit.

In a similar manner Dr. John Fletcher explained the actions of every organic being both in health and disease by the same general law.

In his Pathology, enlarging on John Brown's doctrines, he referred the nature of every disease to a law as simple as that of gravitation.

But for his untimely death his doctrines would have met with universal acceptance.

This Essay is intended as an introduction to his Pathology.

The author is greatly indebted to the Reviewers of his first edition and trusts that in this one he has shown his appreciation of their remarks and has improved the arrangement of his materials.

R. R.

DARTMOUTH.

March 24th, 1879.

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ESSAY

ON

THE NATURE OF LIFE.

BEFORE discussing the clear and lucid theory of Fletcher, who reduced all morbid actions to one, and the same law or general expression, it appears desirable that the terms which Fletcher employs when treating of vital action should be explained: and as vital action implies life this subject first demands attention.

Fletcher's
Theory.

For pathology being merely a branch of physiology, any doctrine of the former must be consistent with the more general laws of vital action, or with physiology. "Health and disease are the same states differing only in degree."* All pathology then must be consistent with

J. Brown's
Axiom.

* To John Brown justly belongs the credit of formulating this axiom, although its truth has been recognized by the earliest writers on Medicine. Indeed the opinions of the ancients upon the nature of disease, before Nosology was considered a science, was far more correct and philosophical than those of Sauvages, of Cullen, and their disciples.

John Brown's
Axiom.

our knowledge of the nature of vital actions in health, or physiology in its more restricted sense.

Paracelsus.

Paracelsus* asserts, "that the human body is nothing but Sulphur, Mercury, and Salt, and in these three things Health and Disease consist. All disease depends on these three things."

Galen.

Galen† also says, "A disease consists in such a preternatural affection of the parts of the body as primarily and of itself hinders their proper and natural action."

Galen, when treating of the causes of Disease, divides them into "Internal (predisposing), and External or exciting."

He remarks, "The external causes of disease are six, which contribute to the preservation of health, when they are well disposed and properly used. These are Air, Aliment and drink, Motion and rest, Sleeping and watching, Retention and excretion, and lastly, Passion."

Asclepiades.

Again, Asclepiades (40 years B.C.) taught that "Health consists in the Symmetry and Proportion of the pores and corpuscles, and Disease in their disproportion."

Asclepiades (as reported by Coelius Aurelianus) considered that "Health consisted in a just proportion between the pores and passages of the body and the corpuscles and masses which pass

* Professor at Basel, 1527, born 1493.

† Galen, born 131 A.D.

Notwithstanding the teaching of John Brown in the last century, and the clear and precise explanation of Fletcher in the early part of this, the nature of life is still a subject of dispute.

Nature of Life.

through them, and that disease consisted in a disproportion of the same."

Hippocrates also considered that disease differed from health only as a state of greater or less action than natural, of some function of the body. He remarks, "Thus for example hunger is a disease, for whatever afflicts man is called a disease."*

Hippocrates.

* * * * *

He also remarks, that "All diseases resemble each other, in their form, invasion, march and decline," and as added by Dr. Samuel Dickson, "whatever its remote origin, Morbid Action is still under every circumstance essentially similar."†

Dickson.

"Disease is neither a devil to be cast out, a humour to be expelled, nor an acrimony to be blunted: neither is it an acidity to be neutralized, nor a putridity to be chemically solved. It is a state to be altered, a variation from a healthy condition of body."‡

Sir Denis de Coetlogan thus defines disease:—

Coetlogan.

"That state of a living body, wherein the principal functions

* Treatise on Airs, Sydenham Society's Translation, vol. i. p. 72.

† *Unity of Disease*, p. 89, of Edition 1839.

‡ *Ibid*, p. 4.

The following remarks on this subject, consist merely of some extracts from Fletcher's Physiology, and a few old notes from his lectures, which, when brought together both show the error of the physical and vital theories of life, and explain its intrinsic nature in all its simplicity.

Coetlogan.

thereof are either obstructed, impaired or in some of them being suspended."

Also, "An indisposition contrary to nature whereby the action of some part is immediately injured."

Or, "A disease is a depraved and disorderly State of the solid and fluid parts; whereby all or some of the functions either of the body or mind or both, are abolished or impaired."

"An ingenious Author holds the *essence* of a disease to consist in a want of that equilibrium between the solid and fluid parts, which is necessary to the maintenance of health."*

Nosologists.

The Nosologists (beginning with Plater and Sauvages of Montpellier in 1768, Linné of Upsal, 1759, Vogel of Göttingen, 1764, and our own Cullen soon after) in their attempts to classify diseases, after the manner of animals and plants, introduced the custom of considering them distinct entities instead of mere modes of existence.

* *A Dictionary of Universal Chemistry*, by Sir Denis de Coetlogan, M.D., Edition of 1745.

The above passage also occurs verbatim in Chambers' *Cyclopædia*. Edition 7th, 1751.

At the present time there are three principal theories of life, the physical, the vital, and the natural.

The physical, supported by Professor Huxley, who considers "physiology a complex branch of mere physics."

Huxley.

A flagrant example of this practice may be observed in the classification of diseases of the skin as if they were objects of natural history.

To add to the confusion almost every writer has a classification of his own and calls the same diseases by names different from those of his predecessors.

An industrious student of the University of Strasbourgh, in the last century enumerated forty-two different classifications in his inaugural essay.

Classification of Diseases.

Since that time an equal number have been added to this list to the perplexity of the student and confusion of medical reports.

It is convenient to divide the paces of the horse into the walk, the trot, the canter and the gallop.

To classify diseases as distinct entities is as irrational as to describe in the same manner the paces of that useful animal.

The Editor of the *Brit. and For. Med. Chir. Rev.* for July, 1875, in his review of Dr. McCall Anderson's work on *Eczema*, says, "There is no necessity for a classification of skin diseases to be defective, except from deficiency of knowledge. What is unavoidable is that no single classification can exhibit all the

Brit. and For.
Med.-Chir. Rev.

Beale.

The vital doctrine, advocated by Dr. Lionel Beale who defines "life as a power, force or property of a special and peculiar kind, temporarily influencing matter and its ordinary forces, but entirely different from, and in no way correlated with any other."*

John Brown.

The natural theory, that life consists in the "sum of the actions of organized beings," was advanced by John Brown in 1770, and systematized and enforced by John Fletcher in 1826, and published in his *Rudiments of Physiology* ten years afterwards.

Fletcher.

"'The physicists' regard life 'as a mere form of Energy,' analogous in its operation and relations to the ordinary physical forces which operate on the

Brit. and For.
Med.-Chir. Rev.

likenesses and difference of these or *any other diseases* for the simple reason that 'disease' is not a natural object, but an artificial and complex conception including a material (?) cause† a physiological [pathological] state and [affecting] an anatomical structure together with such psychological conditions [pathological sensations] as pain and itching."

* *Mystery of Life*, p. 2.

† Can a mental conception or a bodily condition have a material cause?—Erythema may be caused by boiling water but it is not the material water, but its heated quality or condition which excites the diseased action, similarly all other exciting causes of disease.

world around us, and in support of this view, it is maintained that in the substance known as 'protoplasm,' the 'basis or matter of life' has been found the necessary material, in which all the properties, and indeed the source of vital action and power may be said to reside."

"Life or vitality, thus viewed, is merely a property of the protoplasm, similarly as we ascribe ordinary physical properties to inorganic and inert substances."* Huxley.

Prof. Huxley also adds—that "'vitality is a nonsensical fiction' because it can neither be weighed, measured, nor scientifically proved to exist. Life is therefore a form or mode of ordinary force."

Sir William Gull neatly sums up this theory in the dictum—"Life is correlated force." Gull.

The vitalists "maintain that life or vitality is a something, call it a force, principle, or spiritual essence entirely distinct and separate from the matter, through which its actions are manifested." Vitalists.

"The distinct entity of life or vital force therefore constitutes the chief idea in the theory of this sect or party."†

* Andrew Wilson of Edin.—*Student's Guide to Zoology*, 1874. p. 16.

† *Ibid.*

Natural Theory.

The supporters of the natural theory employ vitality to signify that quality of living beings, by which they are distinguished from brute matter, they use the word Life not as either a property or as a power, but only to signify those actions of living beings which show they are alive. The Powers which produce these actions of living beings, are the same which act indifferently on all nature whether living or brute matter, viz., Light, Heat, Electricity, Air, Water or Moisture and Aliment.

Use of words.

All these latter forces are called Powers by Astronomers, Mechanics, and Metaphysicians. The advocates of this doctrine restrict the word Power to the same meaning. These all agree also that a power can act only on some matter external to itself.

Natural Theory.

Thus a living plant or animal, when exposed to heat water and aliment, grows—the susceptibility of growth, of breathing, and of circulation, is called vitality. This growth, breathing, circulation, &c., (which shows that it is alive) is called its Life,* and the heat of the sun, the

* Occasionally Dr. Lionel Beale uses the word Life in this sense. "It was shown that upon it, (Bioplasm), growth, multiplication, conversion, formation, and in short LIFE depended."—*Protoplasm or Matter and Life*. 3rd edit., 1874, p. 184.

water and the Aliment, the powers external to itself which excite the being into living action. Stimuli or Powers are as needful as vitality, to the performance of living action—or life.

Use of Words.

Vitality results from the organic structure of living beings, just as combustibility results from the molecular constitution of combustible bodies.*

In discussing the nature of Life it is most important to keep steadily in mind the distinction between a property, a power, and an action.

Fletcher's definitions.

A property signifies only a susceptibility of motion,

* "Irritability is synonymous with vitality, and signifies the susceptibility of undergoing, on the application of a stimulus, any change which, as not strictly either mechanical or chemical, is characteristic of organized beings." Fletcher's *Physiology*, part ii. p. 52.

"By irritability we merely imply the possibility of the powers† of a protoplasmic mass being called into play by some agent external to itself, and of these the simplest and most efficient is heat." On Protoplasm, *Med.-Chir. Review*, April, 1872.

* Note, APPENDIX.

† If for powers the word faculties were substituted this remark would coincide with the doctrine of John Brown.

a power only a means by which this susceptibility may be called into action, while an action designates the phenomena resulting from the two in co-operation.

Properties.

By a property is understood a faculty, quality, or capability, such as irritability, sensibility, vitality, combustibility, elasticity, and so forth; all of which signify merely a susceptibility of excitement.

Power.

A power is variously understood as a stimulus, force, or agent, such as caloric, light, electricity, air, aliment, attracting force, &c., all of which signify a means whereby this susceptibility may be called into action.

Action.

While the last, like irritation and sensation, life or vital action, combustion, reaction, gravitation, designate the phenomena resulting from the two in co-operation, it would appear superfluous to notice these distinctions, had they not been so frequently lost sight of not only by the οἱ πολλοί but even by authors of merited celebrity.*

Confusion of
Property and
Action

* Every one must have observed the confusion of these terms in common conversation, and how a quality is at once assumed on seeing the action naturally resulting from it.

Thus at a cricket match, one of the spectators seeing "short-leg" make "a splendid catch" six feet from his station, remarks,

A certain analogy pervades the actions of all the natural objects of which man can take cognizance; whether such motions be gravitation, chemical union, or living action, *i.e.* Life.

Analogy of
Actions.

For every action, mechanical, chemical, or vital, there is implied an object with mobility, some extrinsic power to act on this property, and some change of condition or state in which such motion consists.*

what *activity* that "field" displays, when it is obvious that "short-leg" has only displayed to our sight, active motion or action in taking the fast ball, and his *activity* is a mere inference of the mind. Apart from "short-leg" in the concrete, this abstract quality of *activity* could be neither "weighed, measured, made evident to the senses, nor scientifically proved to exist." Yet our belief in "short-leg's" *activity* is as strong as in the colour of his hat-band.

* As we know matter only by its properties, and as we recognise these properties only by their effects upon the senses, our belief in any of the properties of matter is strong in proportion to the impression they make upon our minds; and without implying a separate existence of these properties we still use substantive terms to express them, whether they be combustibility, elasticity, solubility, irritability, or vitality, not one of which can be "weighed measured, or made obvious to the senses." It should be remem-

Properties of
Matter.

Same powers
produce differ-
ent effects.

It is from observing the effect of the ordinary powers or forces of nature, light, heat, electricity, air, water, &c., in calling into play vital, equally with mechanical and chemical phenomena, that the physical doctrine of life has originated, and it is the contemplation of the very different reactions of organised and of inorganic matter when acted on by the same forces or powers that has influenced Beale in forming his vital doctrine, which, however, differs very slightly, from the old doctrine of the Vital Principle.

Physical
Theory of Life.

The Physical theory of Life is explained concisely and clearly by the Editor of the Brit. and For. Med. Rev., for April 1874, on page 308. "That the molecular and massive movements in living beings are *identical* in nature with those of the physical world, and that they are mutually convertible with these, and like them, they obey the laws of *tension* and *energy*, are facts which have not only been recognized by

bered, however, that a property of one body may act as a power or stimulus to another—the pungency of snuff may stimulate the nose.

See Note in APPENDIX on *The Nature of Properties and Powers* from Locke also from Hime.

eminent thinkers, but which have grown almost suddenly into common-places."

This appears a fair exposition of Prof. Huxley's opinions. Huxley.

Professor Huxley considers that "the assumption of a special vital force (*quality*) is illogical and unscientific," (*Physical basis of Life*). "The mechanical actions of the body are governed by the same laws which regulate similar changes of energy (*action*) in the inorganic world." "Where matter is there force (*properties*) must be, showing itself in motion, tension and resistance."*

* That the mechanical actions of the body follow the laws of mechanics, and the chemical actions of the body those of affinity, is a mere truism. The question remains, are there any actions of living beings not strictly mechanical or chemical, and which are therefore called vital?

To speak of "changes of energy" or force, and that "force shows *itself* in motion" is decidedly "illogical and unscientific." A force or power can produce no effect unless in co-operation with some matter having a susceptibility adapted to such force, and by its reaction giving to our minds the notion of force. Professor Huxley talks of "changes of energy;" what is meant by that word is not very obvious. If energy be only another name for

Huxley's
Simile.

"When hydrogen and oxygen," says Professor Huxley, "are mixed in certain proportions, and an electric spark is passed through them, they disappear, and a quantity of water, equal in weight to the sum of that of the two gasses, appears in their place. Here it is obvious that the imponderable electric spark

power, force, or vigour, the ordinary forces of nature are constant, and any extraordinary one is measured simply by its effect. The energy of the sun is as great, whether he shines on the ocean, on the desert, or on the meadow; but his power of exciting vegetable growth is only to be seen on the latter.

The attractive power of the particles of water to each other so as to form ice, is as great at Senegambia as at Mount St. Bernard, but it never shows itself at the former, and continually at the latter.

The sun, as seen from Switzerland and Senegambia, is the identical heavenly body, yet its power of melting water is seldom seen at Mount St. Bernard, but always obvious in Senegambia. Is "the energy" of the sun therefore "changed"?

Maxwell.

What relations "mechanical actions" have to "changes of energy" is simply incomprehensible.

"The ENERGY of a body may be defined as the capacity which it has of doing work, and is measured by the quantity of work which it can do."*

* *Theory of Heat*, by J. Clerk Maxwell, 1875, p. 90.

is not an intrinsic power or force appertaining to oxygen or hydrogen, but an extrinsic force," (acting on their natural affinity, or in other words, exciting their propensity to form a chemical union) "and necessary to their conversion from a state of gas to a state of water," or as should more properly be said, necessary to the display of one of their characteristic actions, from which our knowledge of their peculiar properties is deduced.

In the same way a grain of wheat may, like the gases, remain without alteration for ever, but if exposed to the power of Light, Heat, Air, Moisture and some salts, will display sensible changes of condition. These stimuli not being intrinsic powers of the seed, but external forces necessary to call into action the intrinsic and characteristic properties of the grain of wheat. These characteristic qualities are called vitality.*

Vitality.

If the seed above spoken of be deprived of its vitality by an electric spark, or by being heated to about 212°, and then be exposed to similar Light, Heat, Air, moisture and some salts, instead of growth, there will occur putrefaction, or chemical action.

Vitality and Affinity.

* NOTE 4 APPENDIX, from p. 53 of Beale's *Mystery of Life*.

These stimuli are not intrinsic powers appertaining to the gluten and starch, of which the seed is composed, but exterior forces acting on the intrinsic properties of the dead grain of wheat, and exciting actions peculiar to matter having such properties.

These peculiar properties are called affinity.*

Beale.

Beale would say the seed had lost its "vital force," or "vital power," the influence of which accounts for the phenomena of living action,† but if so, it must at the

Vital and
Chemical Ac-
tion.

* The phenomena of growth and of putrefactions of the grain of wheat are as dissimilar as any of the phenomena of Nature, and as each is caused by the same forces, it is obvious that the matter upon which these forces act must have different properties, or, in common language, be different in kind.

To say that the science of chemical and vital actions are branches of "mere physics" is to make mere physics into the old physiology or the universal science of nature, but this in no wise proves the identity of vital, of chemical, and of mechanical actions.

"Vix illis optari quidquam pejus potest quam ut fatuitate suâ fruantur."

Beale.

† Dr. Lionel Beale challenges the supporters of the Physical basis of Life to show any actions of brute matter at all similar to

same time have acquired a putrefactive power, or force, the influence of which accounts for the chemical phenomena.*

When it is said that the actions of organized beings are peculiar and distinct from such as are unorganized,

Vital Actions
peculiar

the growth of protoplasm in an organized being of the most simple structure.

* If intrinsic vital force be needful for vital action, intrinsic chemical force must be needed for chemical action, and intrinsic mechanical force for mechanical action. It is obvious that all forces acting in such a manner are external to the matters which display vital, chemical, or mechanical action, just as in Professor Huxley's example of the electric force which excited chemical action between the two gases.

What the grain of wheat (above spoken of) has lost, is its vitality, and it has acquired the property of putrefactibility or common chemical affinity.

Vitality is just as mysterious as, and no more so than, putrefactibility. Why, and wherefore, some matter should possess one quality and some another is equally unaccountable. To say that this last quality depends upon a certain aggregation of elements, which always putrefies under favourable circumstances, is no explanation, as the why, and the wherefore, these elements when so associated should have these qualities, remains as before.

it is not meant that organized beings are exempt from all mechanical and chemical modes of action, but that the peculiar actions of organized beings are *sui generis*.*

Sir W. Gull's
vague use of
terms.

In how vague a manner the advocates of the physi-

* Animals obey the laws of gravitation, and some of their actions are mechanical, and some of their constitutional actions are purely chemical, as digestion and the extrication of heat and production of cold; but the formation of the saliva, the gastric and the pancreatic fluids and the bile, all from the same blood, are purely vital actions, and as dissimilar from any chemical, as these are from mechanical action.

Beale.

Beale remarks, that "it is absurd to expect that thoughtful persons will be convinced that vital phenomena are physical and chemical phenomena, simply by an authoritative assertion that they are so."

But the same external powers may excite each kind of phenomena.—If a piece of granite, a lump of salt, and an eel be each thrown into a stream, they will each obey the "murderous law of gravitation;" each is resolved to the solvent and stimulant powers of the heat, air and water in the stream, but they will each display different conduct, and we naturally therefore infer the possession of different qualities: one has gravity and durability, the second gravity and solubility, and the third gravity and vitality; but gravity, durability, solubility and vitality, are each equally beyond the reach of our perceptions.

exposed

cal basis of Life use their words may be seen in the Harveian Oration of Sir W. Gull in 1870.* He there remarks (page 12) "To begin with the lowest series of living things. There will probably be no hesitation in admitting that the vegetable kingdom is no more than *an expression* in a higher form of the terrestrial conditions, which even common experience proves to be in a general way necessary to vegetable life." An expression of conditions !!!†

Sir W. Gull's
vague use of
terms.

Again, at page 25, Sir W. Gull remarks, "Not to occupy time by recapitulating the arguments of the Bridgewater Treatises, which although written from another point of view, would equally prove this unity" (of organism of De Blainville), "I cannot forbear asking you for one moment to consider again this organization of our bodies in relation to the earth we inhabit, and then say if it be otherwise conceivable, but as the expression of the highest correlation of these external conditions."

* From Sir W. Gull's position in the profession, and from his having been chosen Harveian Orator, his opinions may be taken as typical of the doctrines he advocates.

† See NOTE 6, APPENDIX.

Sir W. Gull's
vague use of
terms.

All known vegetables therefore are merely an "*expression* of terrestrial conditions," and the organism of man is an "*expression* of the highest correlation of these external conditions;" whatever that may mean.*

Locke.

* Philosophers, when determined to reject the most obvious conclusions, employ language so ambiguously as to conceal the scope and meaning of their arguments. As Locke remarks, "it is as difficult to refute such men whose notions are thus unsettled, as to deprive of his home a vagrant without a settled habitation."

Expression of
conditions.

Sir William Gull has theological if not scientific authority for this use of the word "*expression*."

Rogers.

"According to the Rev. Mr. Rogers, 'if there is true Protestant blood in this country it is to be found in the veins of Congregationalism rushing warmly through its heart, and sustaining a people who were the logical expression of the principles of the reformation.'" The editor adds, "At the same time there remains the bare possibility that the Church of England may manage to pull through in spite of the hostile attitude assumed by 'the logical expression of the principles of the Reformation.'" —*Western Morning News*, Friday, October 17, 1873.

Gull.

If Sir William Gull uses the word in a mathematical sense, its meaning is still most obscure—a mathematical expression is merely a concise mode of producing a result—and cannot signify individual objects whether organized or inorganic, and "an expression of a correlation of a condition."

Again, at page 13, Sir W. Gull affirms, "That the forces exhibited in animal functions are those previously stored up in plants by assimilation, *is a fixed position in physiology*, and so far the operation of the law of life is plain." Again, Prof. Huxley remarks, "Plants are the accumulators of the *power* which animals distribute and disperse." *Lay Sermons*, 148. Huxley.*

Sir W. Gull's
vague use of
terms.

Huxley.

An animal function is the action of an organ or apparatus, destined to some special purpose in the general economy of an organized being, and like every other action, supposes some matter with a susceptibility

Function.

Upon the meaning of this word Dr. Lionel Beale thus expresses himself:—"Correlation is the abracadabra of mechanical biology. Of late years the term 'differentiation' which was formerly much employed in explanation of biological difficulties, and was once the talisman supposed to solve every constructive mystery, has been degraded to a very subordinate position."

Beale.

The phenomena supposed to be due to "differentiation" are now regarded as the result of "correlation," and the former word once representing, Cause and Law and Action, now stands only for a consequence.†

* See NOTE 8 IN APPENDIX, on Definition of Force.

† *Bioplasm : or Matter and Life*, p. 72.

Vague use of
terms.

of acting, and an external force adapted to act on this susceptibility. The function results from their co-operation. The forces exhibited in the animal functions are like Professor Huxley's electric spark to the gas, not intrinsic qualities, but external powers, as Light, Heat, Electricity, Air, Moisture, Aliment and so forth.

Again, as forces are merely qualities of matter, and not themselves material, how such qualities can be *stored up* is inconceivable.*

Animals assimilate their food, but not the pungency, solubility, cohesion, specific gravity, fluidity, &c., of their diet, all of which, however, may act as forces to excite digestion.

Again, when it is asserted that the powers of Light, Heat, and Electricity are stored up, it must be assumed that these powers are material, and capable of being stored up, instead of being mere motions or vibrations of matter. They can exist only in connection with some matter which displays their characteristic effects.

At page 11, Sir W. Gull asserts that, "the organic processes in their entirety might be correlative of the

* See Note from Hime and Lock in Appendix, No. 8.

lower forces.”* But an organic process is merely an organic action, and the only correlatives of every action are the external powers to, and the intrinsic qualities of, the subject of such action.

The “lower forces” if by that term is understood, Light, Heat, Electricity, Air, Aliment, Water, Conditions, &c., are undoubtedly correlatives in their qualities of stimuli to vitality, and are hence one of the necessary conditions of Life, but as vital action differs, not only in degree, but in kind, from every known physical action, so vitality differs from every known quality of inorganic matter.

Correlatives of
Life

Prof. Huxley, in his writings, repeatedly asserts that vital actions are mere physical phenomena, but the only facts or arguments in support of this doctrine are contained in pages 151 of Lay Sermons, and 86 of Critiques and Addresses. He remarks, “If scientific language is to possess a definite and constant signification whenever it is employed,† it seems to me that we are logically bound

Huxley.

* Sir William Gull, in his Harveian Oration 1870, when advocating the Physical basis of Life. The assent to or disproof of such an assertion, is as difficult as to the equally incomprehensible one that “Heat is square.” *Shute on Truth.*

† The very object of this treatise.

Huxley.

to apply to the protoplasm, or physical basis of life, the same conceptions as those which are held to be legitimate elsewhere."

"If the phenomena exhibited by water are" (give evidence of) "its properties," so are (do) those presented by protoplasm, living or dead (give evidence of) "its properties."*

"If the properties of water may be properly said to result from the nature and disposition of its component molecules, I can find no intelligible ground for refusing to say that the properties of protoplasm result from the *nature* and *disposition*, of its molecules."†

* Professor Huxley forgets his dictum just above, when he assumes that a phenomenon can be a property of the matter making the display by which that property is inferred. A manifestation is not a property in "scientific language."

† This portion of the theory—that the properties of all matter, organized or *bruta tellus*, result from the *nature* and *disposition* of its component parts is no doubt true and as old, at the least, as John Brown, to say nothing of Newton, Bacon, and Archimedes, and it is upon this very argument that John Brown founds his doctrine of the essential difference of living Beings from inanimate matter.

“But I bid you beware, that, in accepting these conclusions, you are placing your feet on the first rung of a ladder, which, in most people’s estimation, is the reverse of Jacob’s, and leads to the antipodes of heaven. —It may seem a small thing to admit that the dull VITAL ACTIONS of a fungus, or a foraminifer, ARE (result from) the PROPERTIES of their protoplasm, and ARE the direct results of the nature of the matter of which they are composed, but if, as I have endeavoured to prove to you, their protoplasm is essentially IDENTICAL WITH” (similar to)* “and most readily converted into that of

Huxley.

The Professor might sup upon lobster, and therefore, he asserts, the intimate particles of each are identical!

Are the properties of the Digestor and the Digested in any sense similar? Can any matter be more unlike than the acting, moving, digesting stomach of the Professor, and the material of the inanimate lobster?

But the properties of water and therefore of the Professor’s stomach and of the boiled lobster “result from the nature and disposition of its molecules.”

The differences of the properties of these two material substances being in every way so great, the substances must differ equally in the nature and disposition of their molecules.

* See Note from Lock on *Identity*, Appendix, No. 11.

Huxley.

any animal, I can discover no logical halting place between the admission that such is the case, and the further concession that all vital action may, with equal propriety, be said to be the result of the molecular FORCES" (properties) "of the protoplasm which displays it."*

"And if so it must be true in the same sense and to the same extent, that the thoughts to which I am now giving utterance, and your thoughts regarding them, are the expression of molecular changes" (actions) "in that matter of life, which is the source" (seat) "of our other vital phenomena,"† "but in the year 1839 it was a vast and clear gain to arrive at the conception, that the vital functions of all the higher animals and plants are the resultant of the FORCES inherent in the innumerable minute cells of which they are composed, and that each of them is, itself, an equivalent of one

* When called into action by some external force—Matter with the property of mobility does not display motion till acted on by some external Force.

Prof. Huxley here uses the word forces as synonymous with the word properties in the first part of the sentence.

† Page 152, *Lay Sermons* of Edit. 1870, "On the Physical Basis of Life."

of the lowest and simplest of independent living beings the Torula.”* Huxley.

* The conception that the vital functions of the higher animals and plants are the resultant of the PROPERTIES inherent in the most intimate particles of which they are composed, when these qualities are acted on by appropriate external stimuli, is very much older than 1839. It was also taught that the most minute parts of the simplest living beings were endowed with similar inherent properties, the only difference being, that what Prof. Huxley calls “FORCES,” John Brown calls vitality or irritability, the peculiar property, inherent in every organized being whether of the highest or of the most humble position in nature.

John Brown
and Fletcher.

In his Lay Sermons, Prof. Huxley asserts, that the “PROPERTIES of protoplasm result from the nature and disposition of its molecules.” If he would only abide by this use of the word Property and allow that all forces must be external to the matter acted on by such forces, the correctness of one half of his opinions would be obvious. Huxley.

In the above paragraphs, Prof. Huxley implies the truth of this doctrine, as he mentions vital functions and vital actions.

A vital action implies vitality, just as combustion implies combustibility and motion—mobility, each of which are inherent properties of the burning and moving bodies, and “result from the nature and disposition of their molecules.”

Huxley.

The only difficulty in Prof. Huxley's hypothesis arises from the uncertainty of his language.

If by physical basis of LIFE he means the physical basis of *living beings*, no one would dispute the truth of his proposition.

As Organized Beings are material, their basis also must be material, and if physical means material, their basis must be physical.

As the characteristic actions of organized beings take place in the most minute parts of their substance, they must necessarily occur in this physical basis, and if this physical basis be called protoplasm, there can be no question that the characteristic actions of such beings take place in the protoplasm.

Prof. Huxley asserts an obvious truth, when he says, that as the peculiar actions of water when acted on by heat, air, gravitating force, &c., depend upon the peculiar properties of the water; so the peculiar actions of the protoplasm, when acted on by heat, air, gravitating force, &c., depend upon its peculiar properties.

Again, as the peculiar action of the brain is thought, the protoplasm of the brain must be the seat of this action, and its peculiar property must be the faculty of thinking.

Thoughts when expressed in words may be called expressions, and hence these expressions may be said to be the evidence of molecular actions of the protoplasm of the brain. But inasmuch as thought is excited by sensation, this last is as much the source of thought as is the faculty of thinking of the brain. Each must co-operate.

Huxley.

Prof. Huxley is obviously correct if he concedes that the properties, not the powers of protoplasm are inherent, and that the powers which act upon it are external to its substance, as described by Fletcher in his Physiology.

Allowing all this, that all organized beings have a physical basis, and that their characteristic actions occur in this basis, it by no means follows that this basis is IDENTICAL in all such creatures.

Identity of
protoplasm.

Indeed as he expressly asserts that the peculiar actions of this physical basis result from their peculiar properties, it is obvious that the physical basis of a professor's brain must differ considerably from the protoplasm of a lobster.

As a proof of their *identity* he continues, "I might sup upon lobster, and the matter of LIFE of the crustacean would undergo the same wonderful metamorphosis

Huxley.

into humanity. Were I to undergo shipwreck the crustacea might return the compliment and demonstrate our common nature by turning my protoplasm into living lobster."

"Hence it appears to be of no great moment what animal or what plant I lay under contribution for protoplasm, and the fact speaks volumes for the general *identity* of that substance in all living beings."*

It is quite true that the similarity of the protoplasm of any one organized being to any other, is greater than that of such protoplasm to the intimate materials of an inorganic body, yet that there is *identity*, or even perfect similarity, between the protoplasm of one species of organized being and of any other, is not rendered probable by each being more or less digestible. If protoplasm is like every other species of matter to be judged of by its properties, the protoplasm of different living creatures, and even of different parts of the same being, materially differ. The protoplasm of the brain differs from the protoplasm of the liver and each from that of the eye and hand.

In concluding these comments on Prof. Huxley's

* *On the Physical Basis of Life.*

argument many of his fundamental assertions may be allowed without conceding his conclusions : Huxley.

That the properties of all matter may be inferred from the phenomena presented by it.

That these "properties result from the nature and disposition of the component molecules of such matter."

That the properties of protoplasm may be inferred equally with other matter from its phenomena.

That the vital actions of all organized beings result from the inherent properties of their protoplasm.

That the vital actions of the lowest organized creatures are similar in kind to those of the most exalted.

That, therefore, the protoplasm of every grade of living beings is similar in kind.

That the substance of organized beings which have ceased to live may be used as food by other such creatures during their living state.

But these propositions do not prove nor render it probable that vital actions can be confounded with mechanical, indeed the phenomena presented by living beings, differ so greatly from any physical motions, that the subject matter of such phenomena must differ not only in degree but in kind, if fact and observation are to be one's guide.

Hence it must follow that the properties of the protoplasm of organized creatures differ essentially from those of brute matter.

Beale.

Beale's arguments and observations upon this point have never been controverted. He says, "Inorganic matter has some obvious and definite structure, but living matter is structureless. The living matter of the most highly organized being cannot be distinguished from that of the lowest, and each of them are equally distinct from mere unorganized brute matter."*

Bioplasm unlike matter in constitution.

In motion.

"Of the several vital movements I have described none can be imitated. They are peculiar to living matter, and not one of them has been explained by physical law."

"No mere physical or chemical attractions or repulsions, on the part of any material particle, at all resemble vital movements."†

Vital actions
sui generis.

"Now the phenomena I have imperfectly sketched—the taking up of pabulum by the living matter, and its conversion into bioplasm; the arrangement of the elements of the bioplasm prior to the formation of the formed material; the moving away of

* *On Life and Vital Action*, p. 26.

† *Ibid.*, p. 35.

“If the method by which non-living matter” (roast mutton or boiled crab of Huxley) “is converted into living matter is (be) understood, by all means let it be explained.” Beale.

“If conversion, like that effected by living matter, can be carried out in a laboratory, let it be done; but if the change can be effected by living matter alone, let this be openly admitted, and let it be clearly stated, and in the most public manner possible, that the phenomena in question are peculiar to living matter, and cannot be shown to be due to physical and chemical changes apart from living beings.”*

portions of the bioplasm from the rest, as occurs in the production of buds or offsets—I hold to be *vital actions*, agreeing in all essential particulars, with corresponding phenomena which occur in every known kind of living matter. These phenomena differ absolutely from any actions known to occur in any kind of non-living matter whatever. They cannot be imitated, and no actions known can be fairly said to exhibit any true analogy with them.”†

“Is there anything I would ask, in the non-living world that can be compared with the series of phenomena which occur in the

*Vital actions
sui generis.*

* *Ibid.*, p. 41.

† *Ibid.*, p. 21.

Beale.
Vital actions
sui generis.

“We have now examined a somewhat extensive range of vital phenomena, and nowhere have we discovered a change or an action peculiar to living matter that could be adequately accounted for by any known facts and laws. The formation of every tissue or organ seems to have been anticipated and prepared for, as it were beforehand; and in many cases changes occur which it is difficult to persuade oneself were not in some sense foreseen, because provision is made for their occurrence long before the changes happen, and the preparation is such that it could only be accounted for,

development of a tooth, and which succeed each other in pre-arranged order? The slow changes by which the growth of every tooth is prepared for, the gradual absorption of the fang of the temporary tooth, the development of the permanent one to replace it, commencing from a time long before the development of the tissues of the temporary tooth had proceeded far, the arrangements providing for gradual changes extending over many years of life by which the permanent tooth is led to its proper place, to say nothing of the contemporaneous changes proceeding in neighbouring tissues—all these I say, involve numerous phenomena, no single one of which has been adequately accounted for.”*

* *On Life and Vital Action*, p. 61.

upon such an assumption. But, in fact this is characteristic of every kind of vital action, although it is much more apparent in some instances than in others. It need scarcely be said, that physicists have failed to adduce any explanation of the phenomena, which like many other facts to which I have adverted is peculiar to life,"* (vital actions) correctly so called.

Attempts have been made to explain muscular action by mechanics, notwithstanding the differences between muscles and machines in every particular, more especially in their formation and repair. Gavarret.

If there were no other argument against the physical theory, the experiments of Gavarret would alone render it questionable. He found that the mechanical work done by a muscle was equal to thirty thousand times, the amount of force employed in exciting it to contract.†

That the absorption of oxygen and excretion of carbonic acid during respiration are not to be explained by chemical laws alone, could be rendered probable by the experiments of Pettenkofer and Voit—if there were not already sufficient proofs of this truth Pettenkofer
and Voit.

* *On Life and Vital Action*, Edit. of 1875, and pp. 95 and 96.

† *Phénomènes Physiques*, p. 225 quoted by Dr. John Drysdale—*Protoplasmic Theory of Life*, p. 146.

These arguments appear sufficient to show that the

in physiology. They showed that the expired carbonic acid is no measure of the quantity of oxygen inspired at the same time. The quantity of carbonic acid expired during the day, by a man at work, being double that of the oxygen inspired during the same time, while the contrary is the case at night.*

But although the oxygen absorbed during exercise is less relatively to the carbonic acid expelled than during sleep—yet the quantity of oxygen absorbed during exercise is much greater,—although not in proportion to the increase of the respiration.

The chief external condition which regulates the absorption of oxygen is temperature.

Oxygen
absorbed in-
creased by
cold.

The quantity of oxygen absorbed by the blood varies inversely with the temperature of the air inspired. This capacity of the blood for the greater absorption of oxygen in cold climates seems to be a provision of nature for the maintenance of the temperature of warm blooded animals.†

Hence the more florid complexion of the inhabitants of cold climates than those of warm,—their greater liability to diseases of the lungs and comparative immunity from those of the liver, as see Climate in Fletcher's *Pathology*.

* *Ibid.*, p. 150.

† Mathius and Urbain—in *Archives de Physiol.*, quoted in *Brit. and For. Med. Chir. Rev.*, April, 1873, p. 506.

physical theory of life does not adequately explain the nature of the action of organized beings.—The Vitalist theory will form the subject of the next chapter.

CHAPTER II.

VITALIST THEORY OF LIFE.

Beale.

THE Vitalist theory of Life is supported in this country chiefly by Dr. Lionel Beale whose researches on the nature and action of Bioplasm mark an era in British Physiology.

He asserts that "Life is a power, force, or property of a special and peculiar kind, temporarily influencing matter and its ordinary forces, but entirely different from, and in no way correlated with any of these."*

* Dr. Lionel S. Beale maintains his doctrine of vitality with much vivacity,† indeed with a degree of warmth that will appear inexplicable a dozen years hence.

† It is to be hoped that Professor Huxley will not object to the use of this term, Vivacity, as he has done to Vitality, because like other abstract qualities, it "can be neither weighed, measured, made evident to the senses, nor can its existence be proved scientifically."

Dr. Lionel Beale, in his work on the Mystery of Life, p. 64, vivaciously remarks: "During the last twelve years, numerous facts elucidated in the course of careful microscopical investigations on the tissues of plants and animals, which have not been called in question, tend to establish upon a firm basis the doctrine of "Vitality," or at

The advocates of this theory treat the subject of Life as if there were only two doctrines of the Nature of Life, the Physical and the Vital, ignoring the views of John Brown and his followers—Cuvier, Bichat, Laurence, &c. Beale.

In his work on "*Bioplasm or Matter and Life*" Dr.

least indicate that the phenomena peculiar to living beings are due to the working of some "Special Power" capable of guiding and directing and arranging ordinary matter, but in no way emanating from, or correlated with, the ordinary material forces. I cannot but conclude from my investigations that the living is separated from the non-living by an impassable barrier"—("la nature semble faire un saut," Bonnet, 1762, quoted above by Fletcher)—"by a gulf that will not soon be bridged over: that matter and its ordinary forces and properties belong to one category or order; and that creative power and will, design and mind and life, ought to be included in a very different order indeed."

"In conclusion, I submit that the arguments advanced by Sir W. Gull and others, do not show that the opinion that life "is a power" entirely different from, and in no way correlated with, matter and its ordinary forces" is untenable. Neither can it be held that the reasoning advanced by him in any way justifies the acceptance of the hypothesis that *life is correlated force*. This physical doctrine restricts advance and retards scientific progress. On the other hand, the theory of "Vitality" helps us to explain many phenomena otherwise inexplicable at this time, while it is not incompatible with any of the truths of physical science. I am quite ready to be *taught*, but I cannot submit to be *forced* into confusion by force, while I retain vital power to resist."—*Mystery of Life*, p. 64.

Beale.

Lionel Beale thus expresses himself: "Let me first state broadly the two antagonistic and incompatible doctrines concerning the nature of everything that is alive. The one which is undoubtedly just now the most popular is, that living matter and non-living matter alike consist of the ordinary matter and forces of our earth, and that the living and the non-living should be included in the same category. The other is, that in things living, in addition to inorganic matter and inorganic forces, is what may be termed *vital force* or *power* which unlike any ordinary force, is *separable* from the matter with which it is temporarily associated, and therefore is in its nature essentially different from every form or mode or mood of ordinary inorganic force."*

Mr. Andrew Wilson in supporting this doctrine says, "life or vitality is a something called a force or principle entirely distinct and separate from the matter through which its actions are manifested. The distinct entity of life or vital force, therefore, constitute the chief idea in the theory of this sect or party."†

* Page 17 and 18, *Protoplasm or Matter and Life*, by Lionel S. Beale. Third Edit., 1874.

† Page 16, *Student's Guide to Zoology*, 1874.

Dr. Lionel Beale's theory of Life being a power influencing matter is hardly distinguishable from the old theory of a Vital Principle, although he repudiated strongly any approval of that doctrine.

Beale.

How Dr. Lionel Beale's opinions represent themselves to impartial persons may be seen in Dr. James Ross's Critique on Dr. Beale's Theory of Life in the *Practitioner*.*

* Dr. James Ross, in a "Critique of Dr. Beale's Theory of Life," in the *Practitioner*, thus describes Beale's theory:

Ross.

"Dr. Beale says that he attributes vital phenomena to 'vitality, or vital power or force, or to life.' Hence it may be inferred that he uses these words as synonymous terms for one and the same power. Let us ascertain, then, what are the attributes he assigns to it. From the title of his recent work, 'The Mystery of Life,' it is evident that he regards this power as a mysterious one: 'it is beyond the range of physical and chemical investigation, and cannot be rendered evident to the senses.' And it is not only a mystery, but a *special mystery* which presents itself nowhere in nature except in living beings: 'it is a power, force, or property of a special and peculiar kind, temporarily influencing matter and its ordinary forces, but entirely different from, and in no way correlated with, these.' This force, however, is not a property of matter, since 'it is essentially different in its actions from all acknowledged properties of matter.' It is not matter, since, as

Beale.

Ross.

Proofs of

The supporters of the vitalist theory of life rely upon the evidence they adduce, that the actions of living creatures differ essentially from mechanical and chemical phenomena and cannot be explained by any known physical laws; secondly, upon the impossibility of explaining either the original organization of a living being, or its characteristic action when organized without the supposition of some special power, force, or influence pervading every particle and constantly directing controlling, and arranging its actions and further the

Ross.

already quoted, it is a power 'temporarily influencing matter and its ordinary forces.' It is not mind, since 'life exists where brain and nerves, the instruments of mind, are not found.' But although this power is not mind, it possesses the distinguishing characteristic of mind, since it is an intelligent principle."

In his Oxford Lecture (1869) Beale, in discussing the nature of muscular motion, considers the act of contraction a function of the *non-living* part. This may be merely a different use of the word *living*, but to ordinary persons muscular action is the best proof and sign of the part being yet alive.

Pettigrew.

Dr. J. Bell Pettigrew mentions the movement of the cilia, the heart and hollow viscera after separation from an animal, as proofs of these parts being still living after such removal.—*Edin. Med. Journal*, Oct., 1872, p. 292.

necessity of this supposition for our belief in a future state.

Proofs of

If it be granted that vital phenomena are essentially distinct from chemical and mechanical actions, then *secondly*, what evidence have we of a vital power, force or influence, and admitting its existence, how far is it adequate to explain the phenomena we call vital?

When discussing the Physical theory of Life, Dr. Lionel Beale was quoted at great length to prove the very evident proposition that vital actions have certain well defined differences from chemical and mechanical phenomena, and it need not require a reiteration of this assertion through 300 pages to procure its general acceptance.

The second proposition that this difference in the phenomena can only be explained on the supposition of a vital force or power is not so clearly made out, indeed the only argument advanced by Dr. Lionel Beale is the continued assertion that such must be the case.

Mr. Andrew Wilson puts the argument very concisely*—"in our researches we never meet with an instance capable of demonstration, of lifeless matter springing of itself into living material."

Wilson.

* *Student's Guide to Zoology*, p. 27.

Wilson.

“Should the chemist bring together the reputed elements of living beings, yet these compounds never exhibit vital phenomena of even the very lowest of organized beings.”

“We still want a something more to make the inert material exhibit the complicated phenomena, which (even in the microscopic animalcula) are characteristic of a living organism. This something the Vitalist holds, to be the Vital Principle or Vital Force, a term often questioned as to its status or right of admission into scientific terminology, but which the physicist is not entitled to expunge and for which he is unable to provide a due or equivalent substitute.”*

Prof. Beale says, “I have ventured to speculate concerning vital powers, simply because I find it impossible to account for the ordinary universal life phenomena without the aid of an hypothesis of the kind.”

Necessity of
Vital force.

Mr. Andrew Wilson acknowledges that though he can prove that vital actions are distinct from those of inorganic matter, although he can show that living organisms originated only from beings previously or-

* *Student's Guide to Zoology*, p. 27.

ganized, yet the "Vitalist theory is unsusceptible of demonstration."*

Necessity of
Vital force.

"And so it is with Vital force. We can not demonstrate its nature, origin or actual relations; yet we are not on that account entitled to assume its non-existence, because the hypothesis of the physicist, in spite of its matter of fact tendencies, tells us nothing new, since its explanations are insufficient to account for the Cause or Future of even the most simple vital action."†

In all fair argument the *onus probandi* rests with the affirmative, and if the Vitalist maintains the existence of an Entity, Professor Huxley with his objection remains master of the field.

Vital force
questioned.

An Entity "which can be neither weighed, measured, made obvious to the senses, nor scientifically proved to exist" may, in all reasonable fairness have its reality questioned.

Professor Huxley is only unreasonable when he objects to the possession by certain matter of a peculiar abstract quality, viz., Vitality, because this quality, like every other property, can not be physically abstracted from its concrete form, and matter, and condition.

* Page 31. † 31 and 32.

Vital force
questioned.

The advocates of the Physical basis of life, consider that if they can disprove the existence of a Vital force, or principle as needful for Vital action, that they have proved their hypothesis.

If, in addition, they can show that Vital action is caused by, and dependent upon the ordinary powers pervading all matter that the truth of their doctrine conclusively follows :—

The supporters of the Vitalist view of living action consider that if they can show that such action differs from every known chemical or mechanical action in kind as well as in degree that their opinion must be undoubtedly true.

That if, in addition, Vital action be shown to commence and terminate differently from every known chemical or mechanical action, their view must be correct beyond controversy.

They consider that such difference must arise from a difference in the forces causing such action, not perceiving that a difference in the qualities of the subjects of such actions would equally explain the difference of the result, and therefore, there is no necessity to conjure up a force, power, or influence different from the ordinary forces of nature, to account for the difference in action.

The slightest reflection is sufficient to show the truth of this. On the application of a red heat to phosphorus, to gunpowder, and to cast iron, the resulting action is very different, yet the force is identical, the different properties of the reacting matter causing the different results.

Vital force
questioned.

To an old pupil of Dr. John Fletcher, the subject appears too simple to bear argument, and any disciple of John Brown will consider the discussion insufferably tedious.

As to a Vital Force inherent in all living beings. —The assumption of its necessity in the formation of the embryo, is thus discussed by Dr. Fletcher.

Necessity of a
Vital force.

It is shown in Note twelve in Appendix that the chemical composition of organized tissues is quite distinct from that of unorganized compounds; and consequently that the first step towards organism must require processes different from those by which inorganic matters are formed. It requires Life, but not a Living Principle.* It requires the Life, or living action ($\Sigma\omega\eta$) of the thing *organizing*; not any Living Principle

Embryo,
organization
of.

* Living Principle is used as identical with Vital Force, Power, or Influence.

Embryo
organization
of.
Fletcher.

($\psi\chi\eta$) in the thing to be *organized*. Organized beings can be formed only by such as are already organized, the existence of any one implying always the pre-existence of some other; and the forming and separating from themselves, each in its generation, such new beings is one of the characteristic actions—of plants and animals in general.*

The organization then of the embryo, or the process by which a new being is formed, is the work of the parent. The organs of the embryo, are rude and undeveloped, but in virtue of its organism are indued with vitality.

Nor does there appear to be any greater difficulty in conceiving this particular application of the process of secretion, of those germs which are the rudiments of beings of a future generation than in understanding that by which every organized being, not only continually

Tyndall

* Mr. John Tyndall, as the result of his numerous experiments and researches comes to the following conclusion.—“As far as enquiry has hitherto penetrated, living beings have never been shown to exist independently of antecedent life.”—

Paper read before the Royal Society, 13th Jan., 1876, and reported in the *Brit. Med. Jour.*, 29th Jan., 1876.

Embryo,
organization
of.

renews, in proportion as they are removed by absorption, its own natural organized tissues, and sometimes whole organs, each of which is equally indued with irritability or vitality. The germ then, so formed by a vital action of the parent, and possessed in virtue of its primordial organism of the property of irritability or vitality, maintains from the first, by the co-operation of this property and the natural stimuli by which it is excited, a series of actions constituting its Life; and it is by the actions necessarily resulting from its peculiar properties when acted on by appropriate powers and not by any Vital Force, that its full elaboration is effected. It is thus, that in animals are formed, by means of the parenchyma laid down from a very early period in the apparently homogeneous germinal membrane, first the three principal layers of the latter, and subsequently all the tissues and organs of the body in a certain definite series; so that, though the organization of the embryo was the work of its parent, its organogenesis is its own, and parts which it received from the former in a state of diffusion and ambiguity become concentrated and determinate.

The common-sense view of the matter appears to be that every organized being is secreted in a rudamental

*Omne vivum
ex ovo.*

*Omne vivum
ex ovo.*

state by a pre-existing organized being, that it possesses from the first, a rudely organized structure, indued with a certain property which being influenced by certain appropriate external powers, certain definite actions necessarily result.

By such actions in the parenchyma laid down in the earliest period of its existence is formed the apparently homogeneous germinal membrane, then the division of this into the three principal layers, and subsequently all the organs and tissues of the body in a certain and definite series.

Creation.

It may be assumed then, that the organization of the embryo implies no greater vital power, force, or influence, than the performance of the ordinary functions of the body. But if the embryo be thus organized by its parent, how, it may be asked, was the first parent organized? If the first egg were the product of a bird, how was the first bird produced? With this problem the physiologist has nothing whatever to do. The Almighty Creator—the first and the last—willed that, not only the inorganic, but the organic kingdom of nature should exist; but how either the one or the other was originally called into being He alone knows who said “Let there be light—and THERE WAS LIGHT”—

“ Whose word leaps forth at once to its effect—

Creation.

Who calls for things that are not—and THEY COME.”

Any attempt, by a finite being, to comprehend the process of creation, is vain and presumptuous in the extreme.* But it may be observed that it is more easy to understand that the first organized being of every species was created with a capacity for living (Vitality), and that this capacity, acted on by the universal powers of nature, gave rise to its Life or Living action than that an Entity or Vital Power was created, which, entering into matter, and uniting it together formed a living being—and that the latter implies a greater infringement of the law οὐδενὲξ οὐδενος than the former is sufficiently obvious.

“ Creation is absolutely and entirely out of our depth, and beyond the extent of our utmost reach. And yet it is as certain that God made the world, as it is certain that effects must have a cause. It is in general no more than *effects* with which the most knowing are acquainted ; for as to *causes* they are as entirely in the dark as the most ignorant. What are the laws by which matter acts on matter, but certain effects, which some, having observed to be frequently repeated, have reduced to general rules ?”

Butler.

Butler “ *Upon the Ignorance of Man.*” Sermon 15, paragraph 4, p. 198 of Steere’s Edit., 1862. Bell and Daldy.

Creation.

The Astronomer treats of the motions of the Heavenly Bodies as they now exist, the Geologist of the crust of the Earth as it is now observed, but neither of these discuss how the subjects of their Sciences were originally formed—out of nothing.

Creation or perpetual Existence is assumed, and also the preceeding ordination of the laws of nature. All subsequent changes being the necessary result of such laws.

But these very laws of nature are merely expressions of man's belief in a necessary sequence of events.

This necessary sequence is supposed to arise from the inherent qualities of objects acted on by powers in perpetual operation.

But why objects should have been created with such qualities, or why such powers should exist, is beyond man's comprehension. It is most philosophical to acknowledge that objects have certain properties because their Maker willed it, and to restrict our discussions to explaining how certain actions (we observe) *naturally* follow from these qualities when influenced by certain powers whose existence we infer from their effects.

Actions are the subject of man's contemplation. Causes are inferred from or measured by observation of such actions.

The question then remains—What evidence do the vital actions of living beings afford, of the existence of a Vital Force, Power, or Principle.

Evidence of
Vital Force.

On this subject Dr. Lionel Beale thus expresses himself.

“It may be childish on my part to attribute this movement, this growth, this formation, and this multiplication, to some mysterious force or power, or agency of the nature of which I know nothing, and to call it *vital power* because it works in living matter only—but is not anything better than leading people to imagine that you have explained to them the whole matter when you have really given no explanation at all, and do not understand the thing you have attempted to explain.”

Beale.

“The words machine, mechanism, machinery, certainly might be applied to soft, structureless, growing, moving matter, and watches, and mills, and steam-engines might be called ‘living things’ but it is not easy to see what would be gained* by the mere substitution of words.”

“My own belief in a power or force different from

* Page 55. *Protoplasm or Matter and Life*, by Dr. Lionel S. Beale, 1874.

Beale.

ordinary force working in things living and essential to their living state.”*

“The real question is, whether there is, in addition to ordinary force, a force or power at work in living things of a nature distinct from any form or mode of ordinary force.”†

On this point Dr. Lionel Beale argues‡ “According to my idea, which however may be considered by some very unphilosophical, there is *something* operating in each kind of bioplasm which in fact determines the kind, by virtue of which the living matter *must* grow and must produce formed material of a certain character, if only it be supplied with pabulum, and be placed under certain conditions. This *Something* is, I believe, a power or force which the bioplasm has derived from pre-existing bioplasm—a force or power which has been transmitted onward perhaps for ages, with or without variation. Condition may indeed modify the action of this power within certain limits, or may prevent its action altogether, but that the action results from the power and

* *Ibid*, p. 23.

† *Ibid*, p. 25 and 26.

‡ Dr. Lionel Beale is all through this argument taken as the exponent of the Vitalist theory.

ought not to be attributed to the conditions is obvious from the fact that one form of bioplasm exposed to the conditions favourable to the developmental phenomena belonging to another kind, will not be so influenced as to exhibit these phenomena."*

Beale.

* It is as curious a phenomenon as any in nature that Dr. Lionel Beale should not have perceived that if, in the above paragraph he had inserted property for power, his conclusions would have been exactly the same.

Property and Power.

That specific actions result from the specific properties of matter is one of the most rudimentary of truths.

If a piece of phosphorus and of iron be exposed to a red heat, the effect in each case is dissimilar, but the power is identical.

In like manner, if a seed of grass, a fragment of a glacier, and of granite are exposed to Heat, Air, and Moisture during a Swiss Summer, the actions resulting are very different. The Powers, Heat, Air, and Moisture are in each case identical, yet growth and liquefaction, and resistance to change are results totally dissimilar.

That the growth the inflorescence, and ultimate formation of many seeds like its former self by the original seed of grass or grain is *caused* by the light, heat, air, and moisture during the Swiss summer admits of precisely the same proofs so that the continued liquefaction of the glacier is *caused* by some of the same forces.

Beale.

"The characters of previous generations are indelibly stamped upon every individual, belonging to each generation, and these *characters* can be transmitted—the power of origination and handing down of newly acquired *properties* and *characters* is limited to bioplasm."

"Bioplasm is the agent concerned in the transmission of all hereditary structural peculiarities."*

Dr. Lionel Beale continues, "the periods of time during which the seeds of different plants will retain their vitality, this must depend upon the inherent *properties* of the bioplasm."†

"Inherent vital peculiarities manifest themselves."

"Is there not something very remarkable in the fact of the existence of powers or properties in the several kinds of bioplasm by virtue of which each [individual] seems to grow and flourish only within its own peculiar range of temperature."‡

"In short, the various forms of bioplasm have their individual *peculiarities* and *characteristics* which they inherit, and may transmit, which are not to be accounted

* *On Life and Vital Action*, p. 66 and 67.

† *Ibid*, p. 69.

‡ *Ibid*, 69.

for by physics, and which seem, in truth, to belong to their constitution.* Beale.

“Each bioplast, by virtue of its inherent vitality, continues to produce successors in regular series.”†

“The general form of the organ is determined by the inherent vital *power* [properties] of each individual portion of bioplasm out of which it is formed.”‡

In these sentences Dr. Lionel Beale has insensibly drifted into common sense, and practically confessed that Vitality is an attribute of organized beings. A “property,” a “peculiarity,” and a “characteristic” are necessarily attributes of matter, and quite distinct from Powers which act directly on such properties. Property and Power.

The differences between the Vitalists, and the Naturalists are more grammatical than physiological. The dispute is more “de verbo than de re—”

But is not, it may be asked, design, such as can be attributed only to some such Vital Force, Power or Influence within them, manifested in the heaving and falling of the chest, the contractions of the heart, and other sensible motions of various parts, as subservient to the several functions of organized beings; and still more in the various molecular actions, whereby with undeviating Evidence of Design.

* *Ibid*, p. 70.

† *Ibid*, p. 77.

‡ *Ibid*, p. 77.

Evidence of
Design.

accuracy every particle of the machine is removed and deposited precisely at the time, and in the quantity that is required, not only originally to form these several parts—the eye or ear, for example, those finished examples of exquisitely adapted workmanship—but subsequently to maintain each in a state of integrity, ever varying yet ever the same?* Undoubtedly; design

* “Notwithstanding the positive assertions that have been made concerning the formation and action of the highest and most complex tissues of man, (that such actions are a branch of mere physics), it is a fact that no one has yet adequately explained how the intricate arrangement of the nerve-fibres is brought about in the skin even of the frog. The nerve-fibres are intertwined and interlace with one another in a marvellous manner. Most important ends are served by this arrangement, which it need hardly be said cannot be accounted for by attractions and repulsions or imitated artificially. Every one will admit that it would be absurd to attribute to physical forces alone, the formation of such an elaborate arrangement of mutually adapted tissues, as that depicted in my drawing, which, however, gives only a very imperfect and rough idea of the animal structure itself.”

“That the complex apparatus I have referred to, was *designed*, and for a definite purpose, no one who studies the details of the structure can doubt. That the ultimate arrangement seen in the

deep and wonderful. But this design is that of the Great First Cause of all things, who has adapted in every case the physical causes—the immediate means—to the end to be fulfilled; not that of this miserable means, which acts, and can act only in blind obedience to the laws imposed upon it.† Nor perhaps are the evidences of design really greater in the motions, sensible or insensible, of the organic, than of the inorganic kingdom of nature, nor is the employment of the terms means and ends—not merely cause and effect—more

Evidence of
Design.

adult was prepared for, and as it were *foreseen* at a very early period of development, even before tissue of any kind was produced, is a conviction that will force itself more strongly upon the understanding the more minutely and thoroughly investigation is carried out.”—*Protoplasm or Matter and Life*, by Lionel S. Beale, M.B., F.R.S., pages 253 and 254.

† “To ascribe,” says Dr. Prichard, “to the Vital Principle such properties is to invest it, not only with reason and intelligence, but with the wisdom and power of an omniscient Creator, who, if He works by second causes, cannot be conceived to endow them with his proper attributes. Such language is an abuse of words, and contrary to every maxim of philosophy” (*On the Vital Principle*, 1829, p. 123).—J. Fletcher.

Prichard.

Evidence of
Design.

appropriate in the former case than in the latter.* The final causes are often no less obvious in the actions of inorganized than of organized matter. Can we behold the revolutions of the planets—the alternations of the seasons, and of day and night—

Hunc solem et stellas, et decedentia certis
Tempora momentis—

at one time the ascent of the waters into the atmosphere, at another its descent in rain or snow—the motions of the sea, the rivers and the springs—the occasional changes on the surface of the earth itself—without recognizing an allwise and omnipotent design? Nor are the molecular actions here also—the aggregation of a crystal or a stalactite for example, or the feathery condensation of a vapour—less indicative of an end in view of their operation, or of consummate skill in regulating and adapting the means to this end. In the latter class of cases, however, we unhesitatingly

Roget.

“Cause and effect,” says Dr. Roget, “are concerned only with the natural powers of Matter—means and end involve the operations of Mind in conjunction with those of Matter,” (*Bridge-water Treatise*, 1834, p. 22). “But such cause and effect frequently imply no less than the operations of an Almighty Mind; and it is impossible that means and end can imply more.”—J. Fletcher.

admit that the design is, not that of the means—of the mere so-called forces of attraction and repulsion—but that of the Great Author of these forces; and why should we doubt that the same is the case in the former also? Nor are even the means employed perhaps less intricate and complicated in the inorganized than of organized matter. When we speak of attraction and repulsion indeed we seem to be speaking of simple forces, producing certain actions; but we are in fact speaking of the actions themselves—those of attracting and of repelling—the forces being in both cases quite distinct from these actions, and consisting of a property of being attracted or repelled on the one hand, and a power of attracting or repelling on the other. And what more do we contend for with respect to Life than that it is, not a Principle operating as a simple force, but a series of actions resulting from the property of vitality operated upon by appropriate powers?*

Evidence of
Design.

Forces of
Nature.

* Magendie says it is “une étrange erreur” to compare vital action to attraction, because, while the laws of attraction are well known, those of vital action lie totally concealed. But the latter part of the proposition is not quite true; nor would it furnish a fair objection to the comparison even if it were. The conditions

Magendie.

Analogy of
Life and Gra-
tation.

There is nothing then in reality more singular in the actions of organized beings than in those of inorganized matters—nothing more indicative of design—nothing more obscure—nothing which stands more in need of a Force, Principle, or resident Entity, to account for it. We may indeed, if we please, in conformity with the

Magendie.

of attraction do not more certainly exist at present than they did before Newton discovered the laws which these conditions obey, nor do those of vital action less certainly exist at present than they will do when the laws which they obey shall have been fully ascertained. The assumed analogy is between the general conditions of the two, as constituting respectively the proper actions of different forms of matter; nor between the specific laws which they severally obey. With how much greater truth is it observed

Wilson Philip.

by Dr. Wilson Philip, "The phenomena of Life are as open to observation and experiment as the phenomena of any of these powers, (*i.e.*, those of attraction, &c.) and we possess no information respecting any of them, but such as is derived from the senses. The greater appearance of mystery arises, not from the greater obscurity of the nature of Life, but from its phenomena bearing less analogy to those of the other powers of nature, than these bear to each other, in consequence of which the former are less frequent objects of contemplation" (*Phil. Trans. republished in Essay on Sleep and Death*, 1835).—J. Fletcher.

views of many philosophers, not only ancient but modern, call these actions of Inorganized matters, chemical and mechanical, their Life; but then, to be consistent, we must either allow, as the ancients did, a Vital Force to inorganized matters in common with organized beings, or we must refuse to the latter a Force of which the former are universally regarded in the present day as destitute. It is not contended that we understand the nature of any of these actions—it is not contended that we advance one step towards explaining them by ascribing them to the agents in question. But it is contended that we understand the nature of vital, as well as of either chemical or mechanical action: and that if we are satisfied to attribute the two latter to the agents above specified, as is universally done, we cannot without great inconsistency refuse to ascribe the former, which are in every respect so analogous to them, to similar agents, instead of to an imaginary Force, of the operation of which there is no more proof nor probability in the one case than in the other. Of the immediate nature of physical properties in general we know absolutely nothing, since we are capable of recognizing their existence only by their effects. We know not how or why a certain aggregation

Analogy of
Life and
Chemical
Action.

Physical
Properties.

Analogy of
Life and
Chemical
Action.

of matter called phosphorus should be capable, when exposed to certain agents under favourable circumstances, of exhibiting the phenomena of combustion ; or a certain other aggregation of matter called ivory should be capable, when struck by a hard substance, of displaying those of sensible motion. But we know that they do so ; and we satisfy ourselves in these instances with stating that the phosphorus is, *qua* phosphorus, combustible, and the ivory, *qua* ivory, elastic, without ascribing to them any Principle of combustion or sensible motion. In like manner we know not how or why a certain aggregation of matter called organized should be capable, when acted on by certain appropriate powers, of manifesting the phenomena of Life. But we know that it does so—that the more perfect is the organism, the more remarkable are these phenomena, and that any change in the former produces a corresponding change in the latter ; and what other proof can we require or possess that organized matter is, *qua* organized, irritable or endowed with vitality, and that it is not upon any Force of Life that these phenomena depend ?*

Vitality.

* Dr. Lionel Beale denies that external circumstances, excite vital actions.

But admitting, it may be said, that quite the lower tribes of Organized beings do not display any actions which may not be explained* without conceding to them a Vital Force, it is impossible so to dispose of some of the more exalted actions of the higher—actions which are surely in no respect analogous to such as are merely chemical or mechanical? If, however, this sovereign principle can be dispensed with even in those chaotic tribes from which each kingdom of organized nature takes its rise—it will be difficult, if not impossible, to say at what point afterwards, in either of the ascending scales, it can be abruptly introduced. For so insidious are the steps by which we ascend from these to the very highest tribes of organized beings, and so slightly superior the actions of each tribe, as we proceed, to those of the one immediately below it, that we are compelled to grant that what was unnecessary to

Vital Force.

* The proof that the growth of a grain of wheat is *caused* by light, heat, air and moisture is as complete as that the combustion of phosphorus is caused by heat, and the presence of oxygen.

The human mind never attains to greater certainty as to cause and effect than the observance of invariable sequence.

Vital Force.

the one can hardly be necessary to the other, and that consequently what we denied to the Fungus and Polype must be denied equally to Man. And with respect to the more exalted actions of the higher tribes of organized beings, such as sensation and thought, these have manifestly no immediate connection with the existence of a Vital Force; since, while on the one hand they are certainly not a necessary consequence of its presumed presence, so on the other they may be easily supposed capable, where they are manifested, of doing without it. Many races of organized beings exhibit no traces whatever of these actions, and are still alive; and even in those tribes which habitually exercise them, they are always periodically to a greater or less degree suspended, as during sleep, and sometimes totally cease for an almost unlimited time, as in comatose diseases, without prejudice to the Life of the being. Whatever Force, Principle or Principles then we may find it convenient to introduce in order to explain these more exalted actions, it is obvious that they cannot be identical with the one called Vital and that it is not they which

Force.

“——agitant molem, et magno se corpore miscent.”

Rational
Principle.

The admission then of one, or even of two such additional Forces or Principles, under the names of

Sensitive and Rational, would not in any degree imply the existence of that called Vital, as the main agent of those baser actions in which alone Life, properly called, consists. On the other hand many of the arguments tending to disprove the existence of a Vital Principle serve to render it probable, *a priori*, that that of either of the others is also imaginary; and that, as one specific property, namely irritability or vitality, which is common to organized matter in general, qualifies it when subjected to appropriate stimuli to manifest those ruder and less elevated actions which constitute Life, so other specific properties, peculiar to certain forms only of such matter, may qualify them when properly acted upon to display those more delicate and dignified actions in which sensation and thought respectively consist. But into this department of the discussion it is unnecessary to enter at present.

Rational
Principle.

The third head of evidence commonly adduced in favour of the existence of a Vital Force is founded on the presumed incompatibility of the opposite doctrine with a belief in the immortality of the Soul. There is in the minds of many persons, not only among the uninformed, but also among the educated, a vague, indefinite kind of impression, that the Vital Principle,

Soul.

Soul.

the Sensitive Principle, the Rational Principle, and the Immortal Principle are all identical; and that he who denies the existence of the first does the same with respect to all the rest. This impression appears to have originated in the ancient complicated absurdity of applying to the three supposed principles of Life, of Sensation and of Thought, and to the one real Principle of Immortality, the same name, as Soul, Spirit and so forth*; an absurdity which, regulating as it has done,

Aristotle.

* An attempt was indeed made at a semi-distinction by Aristotle, who, while he confounded together the Vital Sensitive and Immortal Principles, under the general name of *Ψυχὴ* or *Εντελέχεια* still subdivided this into the *Θρεπτικὴ* or simply Vital, and the *Αισθητικὴ* or Sensitive and Immortal, and at the same time admitted a distinct Rational Principle under the name of *Νοῦς* or *Φρὴν* and a similar distinction was affected by the Romans, who, while they called the Vital and Sensitive Principles collectively *Anima*, distinguished the Rational by the name of *Animus* or *Mens*. Thus Juvenal—

Juvenal.

“Indulsit communis Conditor illis

Tantum Animas, nobis Animum quoque,” &c.

Galen.

Galen again tried an arrangement somewhat different, splitting, as before remarked, the Vital *Πνεύματα* into two classes, under the names of proper Vital and Natural, while he packed on on the contrary the Sensitive and Rational together, under the

as well our most philosophical, as our most familiar expressions on these subjects, has not only always

Soul.

name of Animal. None of these proposed distinctions, however, were ever steadily maintained; and indeed, it was impossible that they should be so, thus discordant and irreconcilable as they were. Dr. Barclay indeed coolly argues that they were all unfounded; and that the four substances in question, real and supposed, are in fact all the same. The Immortal Principle he everywhere identifies with the Rational, as being responsible for the backslidings of the latter; and the Rational again must be identical, he infers, on the one hand with the Sensitive, and on the other with the Vital, for "What," says he, "can it will or think without feeling, and how can sensation subsist without life?" (*On Life and Organization*, 1822, p. 495). Upon such principles as these we might undertake to prove, on the one hand, that a surety is identical with the man for whom he is bound, and, on the other, that the second story of a tenement is identical with the first, and the third with the second, because they cannot respectively subsist independently of each other. Mr. Abernethy had some time before contended against confounding perception and intelligence with mere vitality; (*On Mr. Hunter's Theory of Life*, 1814) and Dr. Prichard rationally concludes that at least the Vital principle and the Sentient, Cogitative and Immortal principle—all which he unfortunately regards as one and the same—"supposing for a moment that both really exist, are entirely dis-

Barclay.

Abernethy.

Prichard.

Soul.

influenced to an incredible extent the ideas of the vulgar, high as well as low, upon these matters, but introduced into the best part of the writings of even the greatest philosophers upon the subject of Life, so much error and confusion, that we are frequently compelled to dissent from one half of those propositions in the remainder of which we most cordially coincide, and close their works in general chagrined and disappointed that what, but for this fatal amalgamation, might have

Alison.

tinct in their nature and attributes" (*On the Vital Principle*, 1829). To a similar effect says Dr. Alison, "Whatever notion we may entertain respecting the existence of a Vital Principle, it has no connection with our notion respecting the existence of Mind, &c." (*Outlines of Physiology*, 1831, p. 3).—J. Fletcher.

James.

In the eighteenth century it was generally held that the Soul and Mind were identical,—thus Dr. James* explains "Thought—the soul (which in man is the principle of determination) can perceive nothing without ideas, that is, without motions impressed from external objects. When, therefore, the various senses are defective, the ideas of the Mind are not clear nor complete."

Under the article *Pyretos*, he quotes Cælius Aurelianus Lib. 1, *de Passionibus Acutis*, in which he mentions that Asclepiades calls the Mind and the Soul the collection of the Senses.

* Dr. James' *Dictionary*, published 1745.

been rendered so clear and perspicuous, should have been presented to us only "through a glass darkly." Upon this subject, however, it is sufficient to observe that no arguments adduced against the presumption of the existence of a Vital Force—tend to shake in the slightest degree, either analogically or otherwise, our faith in—our conviction of that of the Principle of Immortality. That the Soul is something entirely independent of either a Sensative or a Rational Principle, will be demonstrated in future; and that it is independent also of a Vital Force or Principle must in the meantime be obvious to any one who considers for a moment that this latter Force is ascribed indiscriminately to every organized being—a quadruped, a bird, a reptile, a fish, an insect, a worm, a zoophyte, the lowest fungus—while a Soul is imputed to Man alone. The differences in the vital phenomena displayed by the most abject tribes of organized beings and by Man are only in degree; in this respect *Faba est cognata Pythagoræ*; the Principle which we concede to the latter as the cause of these phenomena must be conceded equally to the former; and if in the one case this Principle

"Redit in nihilum quod fuit ante nihil"—

be in the one case "the be-all and the end-all," it

Soul.

must be so in the other also; so that to connect Man's hopes of immortality with the admission of a Vital Force or Principle within him, is so far from favourable, that it is directly opposed to all the best persuasions of religion, natural as well as revealed. But the hopes and expectations of Man are founded, or should be founded, on a basis infinitely more sure than the supposed existence within him of any such Principle—on a basis proper to him, not common to him and the vilest worm or weed—on the suggestions of his reason, and on the strength of his faith; and as, so long as these actuate him, every other evidence of the existence of a Soul must be superfluous, so, were these once withdrawn, every other evidence must be nugatory.

Power of Vital Principle.

So much then for the alleged testimony in favour of the *Existence* of a Vital Force. The next subject of inquiry, had this been established, would have been how far it might be regarded as adequate to effect all that has been ascribed to it: but into this question, after the express and unqualified denial of its existence above conveyed, it seems quite unnecessary to enter. A successful hypothesis has been compared to a key which fits and opens a lock; but when no part of the structure or motions of a lock are such as to warrant a presumption

that there ever was a key, such as has been supposed, made to open it, or that it wants any such key, it seems idle to inquire whether such a key might not be competent, if found, to answer the purpose: we should rather proceed at once to open the lock by such means as its construction and mechanism seem to require, and such as we have immediately at our command. It may be shortly observed, however, with reference to this question, that it is utterly impossible to conceive any single Principle or Force or agent capable of effecting *per se* all, or a thousandth part, of what has been imputed to this mysterious offspring at once of imbecility and boldness, of helplessness and daring. To resist chemical agency—to keep in constant motion the respiratory muscles and heart of animals, as well as to excite all the other muscles of the body, as occasion may require—to generate heat and cold—to effect everywhere the continual deposition and absorption of all kinds of different matters—to select or assimilate the aliment—to form and organize germs—to repair wounds and repel and counteract diseases—and to effect innumerable other processes, must require collectively, innumerable modifications of vitality; the inherent property of organized beings.

Such modifications of the property we infer from

Vital Force
insufficient.

Vital Force
insufficient.

observing the dissimilar actions in different portions of living creatures when influenced by the same power or force.

These various actions should be attributed not to one self-sufficient Force or Principle, however intelligent, but to the effect of common powers acting on the property—peculiar to each particular part of the organized system in blind but implicit obedience to laws imposed upon them by the Supreme Being, and adapted everywhere to the end to be fulfilled.*

It is, however, chiefly the singular and apparently anomalous nature of the characteristic actions of organ-

Prichard.

* It is excellently remarked by Dr. Prichard, "The hypothesis of a Vital Principle is a weapon ready to cut any knot, but capable of untying none" (*On the Vital Principle*, 1829, p. 128); and Dr. Thomson observes that "to employ the term Life or Vital Principle to designate a single cause, power, or property of the organized body, upon which the whole of the phenomena of living beings depend, seems as unphilosophical as it would be if, after inventing a term to denote all the various operations on which the motion of a complicated piece of machinery depends, we should fancy to ourselves that a general term so employed denoted a common power from which all these various operations proceeded." (*Life of Cullen*, 1832, vol. i., p. 450). (J. Fletcher).

ized beings when fully formed, which, as it first introduced, so it still serves to perpetuate the vague notion of some distinct Force or Principle as their cause. A corpse which has just ceased to live, that is to say to display those peculiar actions in which Life consists—respiration, circulation, deposition, absorption and so forth—cannot, without an effort, be conceived to have undergone so great a change, without having lost something—a principle, a power—a force, or energy which it previously possessed, and which was the cause of its living. But if we reflect on these actions, anomalous as they appear, what do we find them in fact amount to, but certain movements of either particles or masses of matter, not certainly identical with, but still very analogous to those which, in inorganized matters, we call chemical and mechanical; and which we are contented to ascribe, not to any Principle of action, but to certain properties of the acting matter, when influenced by certain powers, the reciprocal action of which gives rise to what are called attraction and repulsion? And why need we hesitate to admit that similar, though not the same properties and powers may, in organized beings, be competent, while they are in mutual co-operation, to effect those actions in which Life consists, and which of course

Death.

Analogy of
Life and of
Chemical and
Mechanical
Action.

Death.

terminate on the cessation of this co-operation, as the ingredients of a chemical compound cease to be agitated when their affinities are satisfied, and a watch stops when either the susceptibility of motion in its wheels is destroyed, or the requisite power ceases to operate upon them? It is true a living being *appears* to require no such repeated additions of new ingredients as a chemical compound, and no such frequent winding up as a watch, to avoid falling into the repose of inorganized matter. But we must keep in mind that, in the latter case, while the properties and powers of the substances in co-operation are soon satisfied and exhausted, there is no inherent renewal of these substances, and with them of these properties requisite for their proper actions; whereas, in the former, it is the specific end of some of these actions to give rise continually to new aggregations of matter, distinguished by the same properties, which being influenced by the same powers, the conditions of continual action are never for an instant suspended. It is not then that there is in living beings no addition of new ingredients, and no winding-up, but that this addition and this winding-up are incessant; and all that death implies, therefore, is a cessation of these as the necessary conditions of Life or living action,

not any abstraction of Life, in its character of a Vital Force or Power on which such action depended.* Death.

Death is merely the cessation of vital action. This

* This view of death is not universally held. According to Dr. Bence Jones, it consists "in the stoppage of the conversion of latent force into active force, caused by some arrest of action in the heart, lungs, or brain. This arrest resulting from some direct interference with the chemical actions in the ultimate molecules of the organs."† Jones.

Upon this Dr. Lionel Beale remarks—"seeing that things die which never possessed heart, lungs or brain, at any period of their existence, that no explanation is given of 'direct interference' nor of chemical actions in the ultimate molecules of matter, a new puzzle seems to have been invented for us. As the ultimate molecules of the organs have never yet been demonstrated, nor these chemical actions explained, nor any proof given of the power which arrests the action of the heart, lungs or brain, there is no necessity to discuss the nature of the conversion of latent into active force. Science cannot be advanced, nor knowledge increased by vague statements of this kind."‡ Beale.

† *Lectures on some of the Applications of Chemistry and Mechanics to Pathology and Therapeutics.*

‡ *Protoplasm or Matter and Life*, 70 and 71.

Death.

may result from a want of the requisite stimuli, or from the exhaustion of the vitality of the organized being.

An example of the former is death from privation of air, heat or moisture, but the more usual cause of death is from exhaustion of the vitality, as in all lingering diseases, and more suddenly in cases of shock from lightening, concussion or high temperature.

CHAPTER III.

NATURAL THEORY OF LIFE.*

IN this theory the word Life is used to signify the actions of organized beings.

Life, Nature
of.

Life is an abstract term denoting those actions of organized beings which are fundamental—whether or not others be added to them.

As these actions are called the functions of organized being—Life may be shortly defined as the Sum of the Functions of organized beings.

Bichât.

Organization and vitality are coincident, the commencement of the former always giving rise to the latter, and the cessation of the former resulting in the loss of this, the peculiar property of organized beings.

Vitality.

Under ordinary circumstances, that is on the application of the requisite stimuli, life results.

Life, Nature
of.

Everything relating to the organization and structure of organized beings has a direct relation to their Life, or the Actions which they are destined to perform.

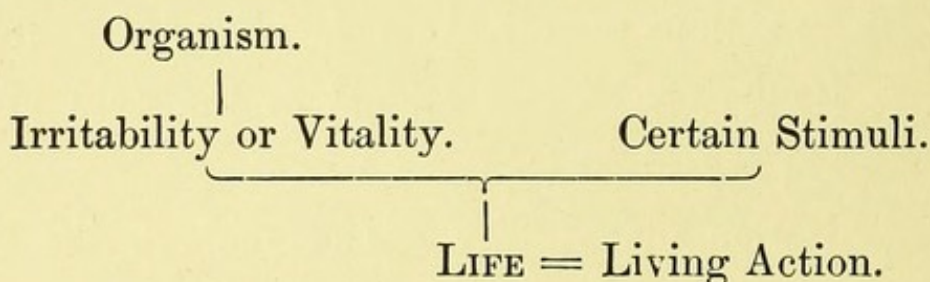
* Taken from Fletcher's *Physiology*, 1836.

Life, Nature
of.

Organism and Life thus stand indirectly in the relation of cause and effect to each other, every organism being susceptible of living when acted on by certain Stimuli in more or less continuous operation.

This susceptibility of living is called irritability or vitality, the property possessed by every organized being, and by which it is distinguished from brute matter.

This relation then of the two may be represented by the following plan.



the living creatures, but a force or principle intimately associated with every particle of the living matter.*

Vital Force or
Principle.

The Entity of Life or Vital Force constitutes the chief idea of this sect or party.†

The following plan may represent this relation of Organism and Life.

$$\text{LIFE} = \text{Vital Force.}$$

Organization. $\overbrace{\text{(Producing Organism)}}$ Living Action.

It is hence obvious that the word Life is employed in two very different acceptations, signifying sometimes that chain of actions characteristic of organized beings; and sometimes a Force or Power—an Entity, whether material or immaterial‡—which, entering certain aggregations of matter, regulates as well their organization—as all the other phenomena which they exhibit.§

* Beale's *Mystery of Life*, p. 2.

† Page 7, above.

‡ *Protoplasm or Matter and Life*, by Dr. Lionel Beale, 3rd Edit., 1874, p. 266.

§ “In ancient times Life in the former of these senses as living action was called by the Greeks *Zωή*, and by the Romans *Vita*; in the latter, by the Greeks *Ψυχή*, and by the Romans *Anima*.

Life.

This argument in the preceeding chapters may be sufficient to show that the attempts of the Vitalists to

Life. We have unfortunately no single term by which to designate the supposed Force or Power, if we employ the word Life to signify merely the chain of actions, and no one by which to designate the chain of actions, if we apply the word Life to the supposed vital force. We can do better, however, without a name for a vital force which pretty certainly has no existence, than for actions which certainly occur. In these two acceptations then the word Life, not only has two totally different meanings, but implies two totally different views of the subject at issue; but there is still a third acceptance in which the term is sometimes employed, distinct from both these meanings, but nevertheless quite consistent with the former of these views, the only difference consisting in this, that whereas the term, as used above, signifies Living action, it is employed in this new meaning to signify irritability or vitality—one of the conditions of this action. Such is the meaning attached to the word Life by Dr. Elliotson, who says of it that ‘it is used sometimes properly for the power (property), sometimes improperly for the result.’ (*Human Physiology*, 1834, p. 31). In the mere application of a term, however, where the proposition signified is the same, that must surely be the best which is the most usual; and as the term Vitality is by general consent appropriated to one of the conditions of living action, and

Elliotson.

Vitality.

establish the existence of a "vital power or force" "temporarily influencing matter" have entirely failed. We

the term Life to this living action itself, the employment of the term Life to signify vitality has only the effect of giving us two terms for the property, while it deprives us of any term at all for the result of it, and is calculated to give rise to a great deal of logomachia which might very well have been avoided. Let it not be imagined, however, that because in this instance the whole point in dispute hinges on the definition of a word, the same is the case in the two acceptations of the word Life previously proposed; for, while no difference of doctrine exists whether the term Life be used to signify living action or vitality, since both are parts of one doctrine, a fundamental difference of doctrine is conveyed by the acceptation of the word Life in the sense of Vital Power, no such force as this being in the former case admitted."*

Vitality.

So large a portion of the controversy on the nature of Life has arisen from confusion of fundamental terms, that in the Appendix, Note 2, will be found a long abstract from "Latham's Grammar," showing that the word Vitality can, in justice to the English language, only be employed to signify an attribute or property of living beings.

Confusion of
Terms.

If Dr. Lionel Beale and Professor Huxley would consent to use the word in that sense, if they would allow with Latham, that

Beale and
Huxley.

* J. Fletcher's *Physiology*. Part 2, page 17 of Edit. 1836.

Definition of
Life.

may reasonably admit that Life is merely an abstract term to denote the sum of those phenomena, the capability of performing which is the result of organization.

Bichât.

Bichât's definition of Life as the "sum of the functions" is precise and exhaustive.

Beale.

Dr. Lionel Beale objects to John Brown's definition of the word "Life" not perceiving that if any word is used by an author in one sense alone—it can matter little to the argument what that sense may be—

Words are neither bad nor good
But only as the're understood—

Bichât.

he remarks*—" *Life not a sum of Actions.*" "Not a few

Confusion of
Terms.

properties are attributes, and agree with mechanics that powers are external to the matter acted on, and if in addition they would use the word Life in only one meaning, this discussion would be reduced to very narrow limits.

This charge of inaccuracy is so grave, that some quotations will be taken from the writings of Prof. Huxley and Dr. Lionel Beale. See Appendix, Note 7.

It is perhaps needless to add that in this treatise Life invariably means living action.

* *On Protoplasm or Matter and Life*, p. 73.

SEE APPENDIX—Note 11, for Authors on the Nature of Life.

have thought to avoid the difficulty of defining what was meant by *life*, *living*, *vital*, by suggesting that the 'life' of any living thing comprehended all the phenomena that proceeded in it. But the assertion that the life of a thing is the sum of all the actions going on in its body while it is alive, does not help us in the least degree to understand the nature of life. The items of such a sum would be so very different IN DIFFERENT CASES, that it would be as absurd to attempt to add them together, as to add ounces to shillings yards and bushels. Neither would any results of the adding up, be comparable, and the one thing required, that which was common to them all, could not possibly be discovered by such a method. In truth, those who teach that *life* is the sum of all the actions going on in a living body, forget that these are not all of the same kind. Of some we know very much, but of the nature of others we know nothing."

Definition of
Life.

Beale.

"Neither can '*vitality*' be regarded as a 'collocation of the forces of inorganic matter' as Mr. Bain expresses it ('Senses and Intellect,' page 60). The supposed collocation he says, is for the purpose of keeping up a living structure. Mr. Bain thinks it unnecessary to account for the collocation."

Bain.

Definition of
Life.
Beale.

“That ‘*life*’ is a collocation of forces for the purpose of keeping up structure that lives—seems a very strange explanation, and one that one would scarcely have expected to have found in the ‘Senses and Intellect.’* In every living thing there are *physico-chemical actions* which also occur out of the body, and also *vital actions*. These last are, however, *peculiar* to living beings, and cannot be imitated.”†

This long quotation occurs seriatim in Dr. Lionel Beale’s *Protoplasm or Matter and Life*, and but for his

Bain.

* Although the definition of Vitality by Mr. Bain is grammatically contradictory in itself, yet Dr. Lionel Beale’s objection to it is obviously unfair.

Mr. Bain defines Vitality in a certain way “a collocation of forces,” &c. Dr. Lionel Beale objects that it is a very strange explanation of “*Life*” to call it “a collocation of forces.”

Mr. Bain does not confound Vitality with Life, the confusion rests with Dr. Lionel Beale.

† Although Dr. Lionel Beale professes to consider Life as synonymous with Vitality, yet he employs the word sometimes to signify a Property, sometimes a Power, the cause of vital actions, but also he occasionally lapses into its usual and proper signification—“the actions which constitute the ‘life’ of (an organized being.)”—See Note 4 in Appendix.

merited reputation as the greatest of living microscopical investigators—would hardly be worth answering.

Dr. Lionel Beale places on a par, or at least in juxtaposition, Bichât's clear definition of Life with Mr. Bain's description of vitality.

Beale's Objections.

The latter is a contradiction in terms—Vitality with any regard to the use of the English language is an attribute or property of matter.

Forces are conditions external to the matter on which such forces excite motion.*

The objection to Bichât's definition of Life—that it would be impossible to sum up all the complex phenomena of life into one total, arises from his mistake in the words.

Facts, actions or circumstances may be summed up in a common term without assuming a perfect knowledge of their nature—it is sufficient if they have a common property.

Bichât uses the expression "l'ensemble," or sum, as

* "Force is any cause which has motion, or change of motion for its effect, and thus all the change in the velocity of a body which can be referred to *extraneous* bodies; as the air which surrounds it, or the support on which it rests, is considered as the effect of force."—Whewell, *History of Scientific Ideas*.

Definition of Force.
Whewell.

Definition of
Life.

defined in Latham's Todd's Johnson—the whole “of anything, many particulars aggregated to a total.”*

A sum is simply the aggregation of a number of ideas having some common quality. Thus, the farmer uses the word Stock as the sum of his animals, and implements of husbandry.

He would consider it a most unreasonable objection to his word Stock (as the sum of his moveable possessions), that he did not understand how his machines were made, nor the position of his animals in Buffon's *Natural History*, and that they were essentially as different as pounds are from a yard measure.

The physiologist uses the word Respiration as the sum of the actions contributing to the aeration of the blood. Some of which are mechanical, some chemical, some muscular, and some sympathetic.

* “Consulting on the ‘sum’ of things foreseen.”—*Milton*.

“Such and no less is he on whom depends

The sum of things.”—*Dryden*.

“Weighing the ‘sum’ of things foreseen with wise forecast,
Solicitous of public good.”—*J. Phillips*.

“The sum of duty let two words contain,

O may they graven on thy heart remain

Be humble and be just.”—*Prior*.

Unlearned people understand what is meant by Respiration, though few could explain the nature of all the processes which contribute to this function.

Dr. Beale's
objections.

Certain changes, motions and actions are peculiar to each individual living being, and not only is it possible to sum up all such actions under the word Life, but by the learned and the vulgar, they are usually included under that term.

Dr. Lionel Beale's simile also gives no support to his argument. It is quite possible to sum up yard measures and pound weights. They are ready summed up to our hands in the term mechanical measures, or with many more heterogeneous things in the term "shop requisites."

Weights and measures, although for some purposes different, are frequently classed in one whole.

Some historians talk of the "life of a nation," meaning all the actions of the various persons forming such nation, however various they may be.

But that all the actions of a living being, however various and incomprehensible, may be summed up in one term, I will quote passages from an author that Dr. Lionel Beale will admit to be a sufficient authority.

"Does the 'life' of one of the higher animals com-

Dr. Beale's
Objections.

prise phenomena distinct in their essential nature, from those which make up the life of a monad? Do the vital actions going on in the latter, approach more nearly to the phenomena occurring in the inorganic, than the *actions which constitute the life of the former.*"*

In short, a creature which lives displays life—and by that word, we mean merely all the actions of this living creature, be they more or less.

"But this does not help us in the least degree to understand the nature of life," says Dr. Lionel Beale.

This may be admitted without any detraction from the definition. It is not the essence of a definition to explain the nature of the thing defined. The use of definition is to promote accuracy of discussion—by guiding us to the correct use of the terms.†

At page 133, Dr. Lionel Beale continues his objections to this definition of Life:—

He says,—“ ‘What is Life,’ is a question that ought to be discussed before the question,—‘What am I,’ is even proposed for discussion. We want in fact, a simple

* *Protoplasm or Matter and Life*, p. 18.

† “A definition explains nothing more of the nature of the term than is implied in the name.”—J. S. Mill, *System of Logic* 1, viii, 5 note.

account of what goes on in a thing that is alive. We want to know the difference between the same matter in the live, and in the dead state."

Dr. Beale's
Objections.

"If such questions are neither philosophical nor scientific, I venture to think they require an answer before any one can progress much in the science of mind; and if philosophers and scientific men were to decide that the question 'What is Life' cannot now, and never is to be answered by science or philosophy, and decree that the subject was not to be studied by those who prosecuted science and philosophy, I should desire nevertheless to find some answer to it—nay, I think this ought to be done, even if the penalty of attempting to do so amounted to philosophic and scientific excommunication."

" 'What is life,' then, is I venture to submit still an open question.—It is one belonging to physiology. It has never been solved, and there is little hope of its being solved, unless a great deal of information that can only be obtained by the most accurate microscopical inquiry, be taken into account."*

In these objections Dr. Lionel Beale confounds two

* *Protoplasm or Matter and Life*, p. 134.

Dr. Beale's
Objections.

subjects of discussion—the way in which the word “life” should be defined, and secondly the explanation of all the actions and processes comprehended under that definition.

Life and
Motion.

Motion as a term is defined by logic;—its laws and results are treated of by Dynamics.

This simile is perfectly parallel. If we define Life to mean the actions of any being that lives, and Physiology the explanation of such actions, the meaning of the word life becomes clear, and the limits of physiology sufficiently well marked.

The most simple child can decide whether a creature does or does not live, just as it can determine whether an object does or does not move.

But the description of all the actions implied in “life” is physiology, as the explanation of all motion is dynamics.

This, however, does not prevent people who are neither physiologists nor mechanics from using the words “life” and “motion” in an uniform and correct manner.

Life then is an abstract term signifying the actions of an organized being.*

* The whole argument is well condensed by the Reviewer of

As to the nature of vitality or the susceptibility of living, there need be no difficulty in conceiving that certain forms of matter may be possessed of properties not treated of in the sciences of mechanics and chemistry—and entirely distinct from these.

Properties of
Matter.

As we infer the possession of combustibility or elasticity in certain matter from their reactions on the senses, so we may infer the property of vitality in other matter from certain reactions we perceive to be peculiar to living beings.*

Also as a combustible substance burns only when oxygen and heat are present—and as the reaction of an elastic substance occurs only when it is struck, so the life of an organized being takes place only when the stimuli to vitality are present.

Vitality.

Also as we infer the combustibility of a combustible substance, only from observing its combustion, and the

the *Brit. and For. Med. Chir. Review*, for Jan. 7, 1871, p. 18, when he says, “Life is merely organism or structure in action, and condition of development has nothing whatever to do with the matter.”

Brit. and For.
Med. Chir.
Review.

* See Note 11, Appendix, for correct meaning of the word Life.

Vitality.

elasticity of the elastic substance from its reaction when struck,—so we infer the vitality of a living being from observing its living action or its life.

Life and
Combustion.

As combustibility and elasticity will not of themselves cause combustion and reaction, so vitality may lie dormant, and not show its results for any period, till called into action by certain powers, and then life results.

The result of organism therefore, is not “Life,” but only a necessary condition of “Life,” viz., vitality, and when we speak of organized matter, we do not mean that it is endowed with “Life,” but only that it possesses a property, which, when acted on by appropriate powers, gives rise to that series of actions properly called “Life.”*

Just as we speak of a combustible substance, not as endowed with combustion, but as possessing a property, viz., combustibility, which, when acted on by appropriate powers (heat and oxygen) gives rise to that series of actions we call combustion.

Vitality as
obvious as any
other property.

Nor is this property of organized matter at all more doubtful, or its effects at all more obscure than those

* For the correct meaning of the word Life, See Appendix, Notes 2 and 11.

properties of matter which are treated of in chemistry or mechanics. Vitality.

The latter indeed more frequently engage our attention, and what is familiar, we easily persuade ourselves to be real and intelligible—the former is seldom the subject of our contemplation, and what is rare appears fanciful and abstruse.

But upon reflection we shall find that we have no more evidence for, and know no more of the nature of combustibility or elasticity than of vitality.

It is from the effects alone of any one of these properties, that we infer their existence and determine their nature.

When we say of one substance that it possesses combustibility, all that we mean is* that when exposed to certain conditions it takes fire—of another that it possesses elasticity, we mean only that when struck it rebounds, and of a third, that it possesses vitality, we mean only that when acted on by certain powers it manifests “Life.”†

We know fully as much therefore of any one of these

* See Appendix, Note 2, from Latham’s *Grammar*.

† “The properties which are peculiar to organized tissues, and to which inanimate matter affords no analogy are said to be *vital*, Carpenter.

Vitality.

properties as of the rest—that is to say, as we know matter only by its properties, so we know properties only by their effects. We know nothing of any one of these properties in the abstract, nor is it therefore by way of an explanation of any of the phenomena in question, that the terms denoting these properties are used.*

and the possession of such properties by a living being, or by a single organ is termed its vitality.”†

* Dr. Lionel Beale objects to Vitality being considered a Property of certain matter, because “the actions of living things cannot be explained thereby,” but as this objection arises from a mistake in the meaning of the mere words—this argument is remitted to the Appendix, Note 4.

Magendie.

“Under whatever terms we may clothe the distinctive property of organized matter, it can signify only, as Magendie remarks, ‘la cause inconnue des phénomènes de la Vie.’ It is not then to any thing that we understand better than these phenomena, but to something which we do not understand at all, that we refer when we attribute them to irritability or vitality; and it cannot therefore, be by way of *explanation* that we employ these terms.”—J. Fletcher, 1837.

† *Principles of Physiology*, by W. B. Carpenter, 1st edit. of 1839, p. 136.

They are employed merely as expressive of our belief in the existence of certain properties which, as recognized by their effects alone, we determine to be distinct, only because these effects are, in different cases, altogether dissimilar.

Vitality.

Vitality* is only one of the conditions necessary to Life—it is only, as it were, the susceptibility of living, or, as the French call it, *l'aptitude à vivre*—and other conditions are still requisite in order to give rise to those phenomena in which Life, consists, *i.e.*, the sum of the essential functions performed by organized beings.

Stimuli.

These Stimuli may be spoken of as either Direct and Primary, or Indirect and Secondary; the former acting *ab initio* on the irritability† of the organs to which they are applied; the latter implying always a previous irritation of some one organ—and consisting in a translation of this irritation, so as to act on the irritability of organs at a distance. This translation of an irritation is called sympathy.‡

* From *Rudiments of Physiology* by John Fletcher, part ii, Chap. V.

† Irritability signifies the peculiar vitality of a particular organ.

‡ “Sympathy is an indisposition befalling one part of the

Sympathy.

Stimuli not
substantial.

Correlatives of
Life.

Thus a pinch of snuff, applied to the schneiderian membrane, excites *ab initio* an irritation in that organ, indicated by the changes effected in its secretions; and this irritation may either go no further, or may be translated by sympathy to the abdominal muscles, and excite there a secondary irritation, indicated by the sneezing which so often follows. Snuff therefore is an example of a direct and primary stimulus to irritability, and sympathy, an example of an indirect and secondary one. It is of importance to remark, however, that these stimuli are not, any more than the irritability on which they act, substantial, although, like irritability, they are necessarily attached to something that is so; and such substances accordingly, in the case of the direct and primary stimuli, are, for the purpose of avoiding circumlocution, always put for the stimulus of which they are at once the source and the vehicle. It is obvious that, if Life be a non-entity, neither of its conditions can be entities,* *i.e.*, neither the susceptibility of living, nor the powers which excite this susceptibility into action.

body, through the defect or disorder of another.”—Sir Denis de Coetlogon’s *Universal History, Art Physic*, p. 911, published 1745.

* See Note from Hime—Appendix Note 8.

When we say therefore that snuff or any other substance is a stimulus to irritability, we mean only that the substance in question possesses some power which acts in this capacity; and we specify the substance only as a summary way of indicating the power which it exercises. We recognise these powers, as we recognise the property on which they act, only by their effects—we know nothing of them abstractedly. They are, in every case, the result of the peculiar aggregation of of matter in which they reside, in the same way as irritability is the result of organism,* but they are certainly no more identical with the substance of which they are characteristic, than irritability is identical with the organized tissues of which it is the attribute.†

Correlatives of Life.

Of the Direct or Primary Stimuli to Vitality, the chief are certain universally diffused agents, such as CALORIC, LIGHT and ELECTRICITY; which act more or less constantly on inorganic matter, and on organized beings—others as the medium by which they are surrounded, whether AIR or WATER which act indeed on

Stimuli.

* See Prof. Huxley's remarks, p. 24.

† Taken verbatim from Fletcher's *Physiology*, part ii, p. 96, published 1836.

Stimuli.

every kind of matter, but of which organized beings alone are continually appropriating a portion to themselves,—also Aliment or the solid and liquid substances—which it is the peculiar function of organized creatures to render part of their own composition; and others lastly which constitute at all times a substantial part of themselves, such as their various FLUIDS, whether crude, mature or secreted. Of the Indirect or Secondary Stimuli, the principal are SYMPATHY and PASSION or INSTINCT and VOLITION.

In addition to these, which may be regarded as more or less constant and salutary Stimuli to vitality, and which, when neither excessive nor defective, constitute what may be called the *Exciting Causes* of HEALTH,* cer-

* “Health and disease are similar states differing only in degree.”—John Brown, 1775.

Hippocrates.

“Hippocrates asserts, that there are as many exciting causes of health and disease, as there are objects, outside the body capable of influencing it,” quoted by Dr. James in the preface to his *Dictionary*, p. 13.

Dr. James.

Dr. James also mentions certain circumstances as causes at one time of Health, at another of Disease. This *Dictionary* was printed in 1743, and dedicated to Dr. Mead.

tain others occasionally come into operation, the result of which is prejudicial,—and it is of these that the Exciting causes of DISEASE consist. Stimuli.

Any of the ordinary stimuli to irritability when in excess are injurious, and when in deficiency are inadequate to excite healthy action, and are equally called causes of disease.

Thus, heat and cold, great light or darkness, too much oxygen as in a diving bell, too little as in a balloon, too great a consumption of nutritious food or starvation, too much moisture in the atmosphere, or too little, are equally causes of irregular vital action or Disease.

The notion of Life to be deduced from what has preceded is that it consists in the sum of the characteristic actions of organized beings, performed in virtue of a specific susceptibility, acted on by specific stimuli; and as this susceptibility and these stimuli, when natural, may be regarded respectively as the *Predisposing* and *Exciting Causes*, as it were, and the actions resulting from them as the *Proximate Cause* of HEALTH, so it is of some change in the first that every Predisposing cause, of some change in the second that every Exciting cause, and of some change in the last that every Proximate

Natural
Theory of Life.

Natural
Theory of Life.

cause of DISEASE severally consist. But on this clear and simple doctrine of the connection between Physiology and Pathology—in this view of the nature of Life—it will be necessary to insist in future.*

* Here Dr. Fletcher alluded to his *Elements of General Pathology* which he did not live to publish, but was edited in 1842 by Drs. Drysdale and Russell. The author hopes to bring out another edition with much additional matter, and authorities collected since its publication.

CHAPTER IV.

CONSERVATION OF ENERGY.

As the doctrine of the "Conservation of Energy or Equivalence of Force" is supposed to apply to the theories of Life, it may be proper to allude to it in this closing chapter.

Conservation
of Energy.

In the former edition, this hypothesis of the Conservation of Energy was discussed, as set forth in a pamphlet by Dr. John J. Drysdale, who explained and enlarged upon this doctrine as taught by Mayer and Joule.

This theory of the Conservation of Energy, however applicable it may be to the phenomena of the inorganic world, has no reference to the properties and actions of living beings—and it is only by the use of the same word sometimes as signifying matter, sometimes certain conditions of matter, or again some of the properties, some of the powers or even the motions of matter, that this hypothesis is made to relate at all to the actions of organized creatures.

This subject is remitted to the Appendix, see note 3

Conservation
of Energy.

and 8 since it has no necessary connection with either of the three theories of Life—but here it may be sufficient to quote what Mayer calls his laws.

Mayer.

1. “That Forces are Causes, and that *causa equat effectum*—is most conclusive.”

2. “Forces and Causes are indestructible but imponderable Objects.”

3. “That which is essential to every Force is wanting in every *Property*—Forces are not properties but objects having the property of indestructibility and the power of taking on different forms—which is the second essential property of all *Causes*.”

As regards Law No. 1—that it is conclusive, cannot be disputed: why it is called a “law” is another question.

“The second general axiom respecting causation is, that causes are measured by their effects,* and hence this first “law” means that a pound weight weighs one pound.

Prof. Tait on
Mayer.

Prof. Tait in his Lectures on *Physical Science* p. 11, thus comments on Mayer’s “Law.”

“The only other fallacy, which I shall mention for the

* Whewell’s *History of Scientific Ideas*, p. 186.

present, is that of basing physical results upon the old dog-Latin dogma, *causa equat effectum*. It is difficult to decide whether the Latinity or the (semi-obscure) sense is in this dogma, the more incorrect.—The fact is that we have not quite cast off that tendency to so-called metaphysics, which has often blasted the already promising career of a physical enquirer.—I say, so-called metaphysics, because there is a science of metaphysics; but from the very nature of the case, the professed metaphysicians will never attain to it.—In fact, if we once begin to argue upon such a dogma as the above, the next step may, very naturally, be to enquire whether cause and effect are simultaneous, or successive—and then we shall have become so mystified about the meaning of the word Cause, that we may well be ready (as many have already done) to enquire what is the necessary ever-acting cause of the uniform motion of a body upon which no forces act.”

Prof. Tait on
Mayer.

Law 2 employs the word Force differently from writers on mechanics.*

Two of the most ordinary forces are Heat and

* See Note 8 in Appendix.

Prof. Tait on
Mayer.

Gravity. These are obviously causes and forces, but not objects in the ordinary acceptation of the term.

An object in mechanics is something perceived by the senses—but for perception by the senses, the object must have properties of some sort, and be therefore material.

Law 2 would be better described, “Forces and Causes are properties of objects—and objects are indestructible, but may lose some of their properties”—only this would be destructive of Mayer’s hypothesis.

Prof. Tait on
Force.

Since the first edition of this work was published, Professor Tait of Edinburgh has brought out his “Lectures on some Recent Advances in Physical Science.”

At p. 16 Prof. Tait thus comments upon the doctrine of force.

“The definition of force in ‘Physical Science’ is implicitly contained in Newton’s *First Law of Motion*, and may be given thus:—

Force is any cause which alters or tends to alter a body’s state of rest or of uniform motion in a straight line.

“The only difficulty, and that is a serious one, which we feel here, is as to the word Cause; for this amongst material things usually implies objective existence. Now we have absolutely no proof of the objective ex-

istence of force in the sense just explained. In every case in which force is said to act, what is really observed, independent of the muscular sense (whose indications like those of the sense of touch in matters concerning temperature of bodies, is apt to be excessively misleading), is either a transference or a tendency to transference of what is called Energy from one portion of matter to another. Whenever such a transference takes place, there is relative motion of the portions of matter concerned, and the so-called forces in any direction is merely the rate of transference of Energy per unit of length for displacement in that direction. Force then has not necessarily objective reality any more than has Velocity a Position."

Prof. Tait on
Force.

"The idea (word) is still a very useful one, as it introduces a term which enables us to abbreviate statements which would otherwise be long and tedious."

"But as Science advances, it is in all probability destined to be relegated to that Limbo which has already received the Crystal spheres of the Planets, and the four Elements along with Caloric and Phlogiston, the Electric Fluid, and the Odic and Psychic Forces."*

* Some authors speak of Force as an entity—just as Dr. Lionel

Prof. Tait on
Force.

It is quite obvious that if Force can have no objective reality, it is useless to disprove its conservation; it is not equally certain that relative alterations in the "motions of matter are caused by a transference of Energy."

From the beginning to the end of Prof. Tait's work, no simple example is given of such a transference of Energy as can be substantiated by experiments.

What is shown is merely that one action ceases and another begins; but there is neither proof nor probability, that the Energy causing the first action is passed bodily on to the matter which is the subject of the second. Prof. Huxley's objection to Vital Force is equally applicable to Energy. He considers the former to be a "nonsensical fiction, because it can be neither weighed nor measured, made obvious to the senses, nor scientifically proved to exist."

Mayer.

Law 3 is a contradiction in terms, if the English language be permitted to have meaning.

Beale does of Vitality—thus, "Since it seems to be an established doctrine, that the function of Nerve cells is to store up and expend FORCE, the application of these principles to nerve-muscle phenomena seems quite allowable."—*Brit. and For. Med.-Chir. Review* for Oct. 1875, p. 292.

The most common Forces are undoubtedly properties of matter and not themselves material.* Mayer.

That causes are neither objects nor indestructible, has been well shown by James Mill who proves that Cause and Effect are mere names to signify antecedent and consequent action.

These terms denote nothing (See Note 3 Appendix) beyond necessary succession.

In Pathology, at any rate, some of the best recognized Causes of Disease are not "Objects, neither are they indestructible nor endued with properties of any kind, nor have they the power of taking on different forms, but are simply the qualities of certain objects, external to the organism in which they excite that change of action which we call Disease." Causes not
Objects.

Such are Heat, Electricity, Disease or Irritation of one part when it becomes a cause of disease in another. Passions of the mind and Cold, or more correctly the abstraction of the natural heat, of the body—some examples of which will be found in the appendix.

The very general acceptance of this doctrine of the conservation of Energy, as applied to organized beings

* See note 8 from Dr. Hime. Appendix.

Causes not
Objects,

will not be considered an argument for its truth by those who remember the first promulgation, the prevalence and the decline of Dr. Liebig's absurd chemical doctrines—which after influencing the medical profession for thirty years—yet fell to pieces the moment they were subjected to impartial criticism.

Like many other hypotheses, it was admitted by the multitude without examination, and dismissed without argument, and philosophers will now adopt some other ephemeral doctrine, which, like the varying fashions of our women are, one year, the subjects of veneration, and the next, objects of contempt.*

Beale.

* “It does not follow by any means that because doctrines are popular they are correct, or in any way nearer the truth, than views which have not had the advantage of having been forced into notoriety.”—*Bioplasm*, p. 176.



“In reading authors, when you find
Bright passages that strike your mind,
And which, perhaps, you may have reason
To think on at another season,
Be not contented with the sight,
But take them down in Black and White;
Such a respect is wisely shown
As makes another's sense one's own.”*

* John Bryom, of Manchester, F.R.S., Late Fellow of Trinity College, Cambridge, died in 1763.



APPENDIX.

NOTE I.

DEFINITIONS OF TERMS, BY DR. JOHN FLETCHER, 1836.

Note 1.
J. Fletcher.

It appears to be of essential importance that the meanings attached in the following pages to the words "Organized" and "Life," as well as to some others more or less allied to, and therefore liable to be confounded with them, should be from the first precisely defined. How frequently do we find authors, with whom we agree perhaps in fact, perplexing us with propositions to which we cannot assent, from having attached to the words which they employ meanings totally different from those in which they use them. Nothing, for example, is more common than the proposition, "Life results from organization," and nothing perhaps is less exceptionable than the *fact* intended to be conveyed; but the principal *words* are entirely misapplied—the sentence should have stood, "Vitality results from Organism." The following short glossary will, it is hoped, obviate

all ambiguity and misunderstanding on this score in the present instance.

Note 1.
J. Fletcher.

Organ—A part of a plant or animal more or less distinct from the rest, and destined to perform, either alone or in conjunction with others, some specific function.

Organization—The *process* by which a being possessed of organs is formed (*e.g.* the formation of a germ).

Organism, or Organic Structure—The *structure* of a being so formed. [Dr. Barclay is among the very few who have, with great propriety, made this distinction between organization and organism. The title of his Essay therefore, “On Life and organization,” has a very different meaning from that of the present Treatise, “On Organism and Life;” the former implying that Life is the cause of the process by which an organized being is formed; the latter, that organic structure is a condition necessary to the manifestation of Life].

Organized—Possessed of such a structure.

Organogenesis—The process by which the several organs become perfectly distinct from each other (*e.g.* the development of a germ).

Organic—Appertaining to organized beings.

Vitality or Irritability—The property which characterizes organized beings of being acted on by certain

Note 1.
Fletcher.

powers, otherwise than either strictly mechanically, or strictly chemically.

Life—The sum of the actions of organized beings, resulting directly from their vitality so acted on.

It is constantly in these acceptations that the foregoing words will each be used in the text of the following work; and where a different meaning seems to be attached to them by authors cited in the notes, the sense apparently understood will be at the same time expressed in a parenthesis.—J. Fletcher.

NOTE II.

MEANING OF THE WORD VITALITY.

“THERE is no greater impediment to the advancement of knowledge than the ambiguity of words.”* Note 2.

“Every department of science has suffered more or less in consequence of the inaccurate use of terms by exponents who have been popular in their day.”† Beale.

Prof. Huxley considers that “scientific language should possess a definite and constant signification whenever it is employed.”‡ Huxley.

The greatest part of this controversy has arisen from uncertainty in the meaning of words.

The disputants really differ more in the use of the words Vitality, Power or Stimulus, Function and Life, than in their belief in the properties, nature, and condition, of animated beings.

* Dr. J. W. Anderson on *Hysteria*.

† *Protoplasm or Matter and Life*, p. 161.

‡ *Lay Sermons*, p. 152 of Edit. 1870.

Note 2.

From Latham's *Elementary English Grammar for the use of Schools*. Twenty-first thousand. Longmans. PART III. ETYMOLOGY.

Latham.

One, then, of the functions of Grammar is, to *represent Language as it exists*; language being a fact which we must take as it is found.

§ 64. We now come to four new terms, that mutually illustrate each other. They run in pairs: (1 and 2), *Substance and Attribute*; (3 and 4), *Abstract and Concrete*.

Take (for instance) an orange. It strikes our senses. We see with our *eyes* that it is more or less *round*, *i.e.* that it is endowed with the *property or quality of roundness*. We see, too, that it is more or less *yellow*, *i.e.* that it is endowed with the *property or quality of yellowness*. We see that it is more or less *smooth*, *i.e.* endowed with the *property or quality of smoothness*. Our eyes tell us all this; the sight being the sense by which our belief as to the properties in question is conveyed to us. They tell a great deal more; but this it is unnecessary to enlarge on.

Then comes the evidence of our other senses.

By our *ears*, we detect a sound if we rub the skin with our fingers.

We *smell* it and find a peculiar and not unpleasant aroma.

Note 2.
Properties or
Attributes.

We *taste* it and are gratified with a not unpleasant flavour.

We *feel* that it is elastic, or endowed with the attribute of elasticity. We feel, too, that it has a certain figure and size. We feel, too, that it has a certain weight.

On the strength of all this we say that an orange is *round, yellow, smooth, capable of exciting sounds, fragrant, sapid, elastic, &c.*

When we say that an orange is this, we *attribute* to it certain properties, or qualities. What are they? The qualities, or properties, of *roundness, yellowness, smoothness, sonorousness, fragrancy sapidity.*

And how do we speak when we say that we do so? It is convenient to begin with saying how we do *not* speak. We do *not* say that an orange has *the property of round, yellow, smooth, &c.* On the contrary, we say that it has the property of *round-ness, yellow-ness, smooth-ness, &c.*

So much for the attributes of an *orange*; at least, for some of them. The attributes of a *guinea*, a *loaf*, a *man*, a *fish*, or anything else, may be considered in the same

Note 2.
Properties or
Attributes.

way. They are, of course, when taken altogether, different from those of an orange. The principle, however, of considering them is the same.

Let us now suppose that all these attributes are, one by one, taken away, *and replaced by others*; that instead of an orange striking our eyes and sense of touch as round, it strikes them as square, or rhomboid; that it loses its fragrance and becomes foetid; that it sounds like a bell, and tastes like a loaf of bread. Would the object still be an orange? Would it not be something else? This leads to the question of the *essential* attributes or *essences* of things. Never mind them for the present; but put your thought in a somewhat different direction.

Divest the orange of all its attributes *without supplying it with new ones*. What will it be then? Take away its original colour without replacing it by any fresh one. Let it lose its softness without becoming hard, its roundness without becoming of any other form. Annihilate its weight, taste, and smell. Let it have no means of appealing to eye, ear, taste, smell, or touch, so that it become, at one and the same time, impalpable, invisible, imperceptible. What will it be then? Will it be anything at all?

What becomes of the attributes? We have seen that they were taken away. What was done with them? They were taken away *separately*, and it is separately that they are put aside. *Roundness* and *yellowness* no longer go together. Each is in its own place; and that is a place by itself. No link now unites them; the orange in which they met being no more.

Note 2.
Properties or
Attributes

But we may unite them afresh; say in the idea of a golden ball, a guinea, a full moon, &c. And we may also separate them, again and again. United, they give the idea of an object clear, palpable, sensible. Separated, or abstracted from those objects, they do nothing of the kind. Yet the mind takes cognizance of them. The idea of the particular attribute of yellowness, abstracted from an orange, is not much more difficult than the idea of the orange *minus* the attribute of yellowness. It is merely a case of difference and remainder; the additions and subtractions being made unconsciously and instinctively.

What becomes of the orange? Is it annihilated by the abstraction of its attributes, one and all? Few are prepared to say *yes* to that question.

Few divest themselves of the notion that sensible, and material objects are nothing more than the combina-

Note 2.
Properties or
Attributes.

tion of certain properties, qualities, and attributes, each and all of which may be removed in such a way as to leave an absolute nothing.

We rather imagine that, where there are certain attributes in union, there is a certain link which connects them; a basis, or foundation, which supports them; a basis, or foundation, different from the attributes themselves, but upon which they rest.

Substance.

This *something* supports them. This something stands *under* them. This something is the *sub-stance*, or *under-standing*, of objects opposed to, and contrasted with, their *attributes*. Now Concrete terms are the names of Substances; whilst Abstract terms are the names of attributes; *e.g.* :—

ABSTRACT.		CONCRETE.
Brightness,	} are Attributes of the Substances }	Sun.
Heat,		Fire.
Light, &c.		Spark.
Mortality,		Animal.
Vitality,		Man.
Animality,		Horse.
Solidity,		Wood.
Resistance, &c.		Stone.
Fluidity, &c.		Water.

Vice Versa.

CONCRETE.		ABSTRACT.	Note 2. Properties or Attributes.
<i>The Sun,</i>	} are Substances with the Attributes	<i>Brightness.</i>	
<i>Moon,</i>		<i>Heat.</i>	
<i>Stars, &c.</i>		<i>Warmth.</i>	
<i>Man,</i>		<i>Mortality.</i>	
<i>Horse, &c.</i>		<i>Animality.</i>	

“And for the security of such species as are produced only by seed, Providence hath endued all seed with a lasting *vitality*, that so if by reason of excessive cold or drought, or any other accident, it happens not to germinate the first year, it will continue its fecundity, I do not say two or three, nor six nor seven, but even twenty or thirty years;” and when the impediment is removed, the earth in fit case and the season proper, spring up, bear fruit, and continue its species.*

* John Ray, F.R.S., *The Wisdom of God manifested in the Works of His Creation*, London, 1742, pp. 65 and 66.

NOTE III.

CAUSE AND EFFECT.

Note 3.
Causes and
Effect.
Archbishop of
York.

As regards our knowledge of cause and effect the Archbishop of York thus expresses himself :

“ All knowledge is experience of facts acquired by the senses. The traditions of older philosophies have obscured our experience by mixing with it much that the senses cannot observe, and until these additions are discarded, our knowledge is impure. Thus metaphysics tell us that one fact which we observe is a cause, and another is the effect of that cause; but upon a rigid analysis we find that our senses observe nothing of cause or effect; they observe, first, that one fact succeeds another, and, after some opportunity, that this fact has never failed to follow—that for cause and effect we should substitute invariable succession. An older philosophy teaches us to define an object by distinguishing its essential from its accidental qualities; but experience knows nothing of essential and accidental; she sees only that certain marks attach to an object, and after many observations, that some of them attach invariably, whilst others may at times be absent.....

As all knowledge is relative, the notion of anything being necessary must be banished with other traditions."* Old pupils of Fletcher will recognize these ideas.

Note 3.
Causes and
Effect.

Again, James Mill says, in his *Analysis of the Human Mind*, "Names to mark the antecedent and consequent in all constant successions were found indispensable. Cause and effect are the names we employ. In all constant successions, Cause is the name of the antecedent, Effect the name of the consequent. And, besides this, it has been proved by philosophers that these names denote absolutely nothing."† The writer adds in a note that this has been proved "chiefly by Dr. Brown, of Edinburgh, in a work entitled" *Inquiry into the Relation of Cause and Effect*, "one of the most valuable contributions to science for which we are indebted to the last generation."

Mill.

Brown.

Now it may be observed, as an example of the fertility of Hume's mind, which, like Hobbes's, often threw out in a sentence or two, and in the course of other enquiries, new ideas which might have formed the

* *The Limits of Philosophical Inquiry*, page 4.

† *Analysis of the Phenomena of the Human Mind*. Vol. ii. p. 37. London, 1829.

Note 3.
Causes and
Effect.

Hume.

Bisset.

subject of volumes, that Hume, in the eighth section of his *Enquiry concerning the Human Understanding*, a section on the subject of "Liberty and Necessity," has expressed in a single paragraph the conclusions of Brown's "Inquiry into the Relation of Cause and Effect." "It seems evident," says Hume, "that if all the scenes of nature were continually shifted in such a manner that no two events bore any resemblance to each other, but every object was entirely new, without any similitude to whatever had been seen before, we should never, in that case, have attained the least idea of necessity, or of a connection among these objects. We might say, upon such a supposition, that one object or event has followed another, not that one was produced by the other. The relation of cause and effect must be utterly unknown to mankind. Inference and reasoning concerning the operations of nature would from that moment be at an end; and the memory and senses remain the only canals by which the knowledge of any real existence could possibly have access to the mind. Our idea, therefore, of necessity and causation, arises entirely from the uniformity observable in the operations of nature where similar objects are constantly conjoined together, and the mind is determined by custom to infer the one from

the appearance of the other. These two circumstances form the whole of that necessity which we ascribe to matter. Beyond the constant *conjunction** of similar objects, and the consequent *inference* from one to the other, we have no notion of any necessity of connection.†

Note 3.
Causes and
Effect.

I think that this amounts precisely to the conclusion above expressed by James Mill, as proved by Brown, that, in all constant successions besides this, Cause is the name of the antecedent, Effect the name of the consequent, the words Cause and Effect denote absolutely nothing.”

Taken from *Essays on Historical Truth*, by Andrew Bisset, page 143, London: Longmans, Green, & Co. 1871.

Dugald Stewart thus expresses himself on this subject:—

Dugald
Stewart.

“It seems now to be pretty generally agreed among philosophers, that there is no instance in which we are able to perceive a necessary connection between two

* The two words “conjunction” and “inferences” are in italics in the original.

† Hume’s *Essays*, vol. ii. pp. 82, 83, Edinburgh, 1825.

Note 3.
Causes and
Effect.

successive events; or to comprehend in what manner the one proceeds from the other, as its Cause. From experience, indeed, we learn that there are many events which are constantly conjoined, so that the one invariably follows the other; but it is possible, for anything we know to the contrary, that this connection, though a constant one, (as far as our observation has reached) may not be a necessary connection; nay it is possible that there may be no necessary connections among any of the phenomena we see; and if there are any such connections existing, we may rest assured that we shall never be able to discover them.”*

Dugald Stewart in a note, quotes a passage from Hobbe showing that he expresses himself with respect to physical connections in terms so nearly approaching Mr. Hume’s that it is difficult to suppose that they did not suggest to him the language which he has employed on this subject.”†

Mitchell.

Dr. Arthur Mitchell in the *Edinburgh Medical Journal* for Dec. 1871, remarks—

* *Elements of the Philosophy of the Human Mind*, 5th edit., of 1814, p. 71, vol. i.

† *Ibid.*, p. 546, vol. i.

"In these papers a state of mind has often been spoken of as *the Cause* of a state of body, or *vice versa*; but the cause, of course, had in its turn a cause, and so on backwards, to what, we cannot often tell. It seems desirable, therefore, to point out that, in speaking of *causes* here, little more is meant than *related antecedents*. We have, indeed, not yet travelled beyond this, but the journey we have made may nevertheless be important and productive of useful discovery."

Note 3.
Causes and
Effect.

"A cause is merely that which the mind selects as the sign of the coming of that other phenomenon which it calls an effect. The connection between the phenomena, is the work of the mind and of the mind only."*

Shute.

"When we say a Cause is merely the sign of the Effect, we obviously mean simply that the cause is that thing or phenomenon whose perception will arouse in us an expectation of the perception of the Effect."†

"Causes are abstract conceptions."‡

* *Discourse on Truth*, by Richard Shute, M.A. of Christ Church, Oxford, p. 106, edit. of 1877.

† *Ibid.*, 107.

‡ *History of Scientific Ideas*, by W. Whewell, p. 184.

NOTE IV.

DR. LIONEL BEALE'S HYPOTHESIS.

Note 4.
Beale.

"DR. (Sir William) Gull, like many who disapprove of the *vital theory*, admits that he cannot fully explain vital phenomena. Vitality is then, after all, a mystery. But some of us are convinced of the truth of facts which justify us in concluding that the mystery is to be accounted for only by supposing *an agency, force, or power*, of an order different from that in which the forces of the non-living world are included; while others maintain that life will eventually prove to be but another mode of the ordinary forces of matter.

For my part I am ready to abandon altogether the idea of vitality, and to dismiss it with other ideas, considered by the new school as mere prejudices imbibed during the irresponsible state of childhood, as soon as convincing evidence of error shall be adduced; but I refuse to give up these for the threats or gibes of a school whose tenets rest upon the mere authority of modern assertion, and whose forcible dicta, however determined and arrogant, are justified neither by reason, nor by observation, nor by experiment."*

* *Mystery of Life*, by Lionel Beale, M.B., p. 53.

DR. LIONEL BEALE'S ARGUMENT AGAINST VITALITY BEING
CONSIDERED A PROPERTY.

Dr. Lionel Beale objects to Vitality being considered a Property of certain matter, because "the actions of living things cannot be explained thereby"—his remarks are as follows:—

Note 4.
Beale.

"Neither are the actions of living things to be explained by the properties of the matter of their bodies, for these are permanent endowments, while the *vital properties* seem to be superadded to matter temporarily. The first class of properties remains permanently attached to the elements of matter; the last may be removed once, but can never be restored. The material properties belong to the matter whether living or dead—but where are the vital properties of the dead material? If physicists or chemists would restore to life that which is dead, we should all believe in the doctrine they teach.* So long as they tell us their investigations only

* "Properties are inherent to objects"—Latham's preface to *Todd's Johnson*, p. 100.

Note 4.

tend towards such a consummation, they must expect a few of us to remain unbelievers for the time.”*

Objections to
Beale.

The motions of lifeless things are not explained by their properties—but their properties are inferred from their motions and reactions—and why should a different method be employed to discover the properties of living beings?

It is true that in common conversation water is said to flow down hill because it is fluid, and a rock to maintain its position because it is solid, but in truth, the fluidity of water, and solidity of the granite is inferred from observation of these facts, and these words fluidity and solidity, mean merely that water flows down hill, and a granite rock remains stationary. In a similar manner, as long as an organized being retains its organic structure, it displays certain reactions when influenced by appropriate stimuli, these reactions we call life or vital action, and, therefore, we infer the possession by this organized being of vitality by which is meant merely the susceptibility of living.

Whewell.

The observation of the motions of bodies was the origin of the science of Dynamics. The inference that

* *Protoplasm or Matter and Life*, p. 45.

these motions were produced by certain forces acting on certain properties of matter was a secondary process in men's minds, and the classification of such motions by a rule or law was the third and crowning point of the Science described by Whewell in his *History of Scientific Ideas*, b. iii, c. i.

Note 4.
Whewell.

That properties are inferred from the observation of phenomena it is sufficient to quote Dr. Lionel Beale, in another place—he says:—

Beale.

“Neither man, nor any living thing, nor any kind of living matter, can be dissolved—for that which *lives* is incapable of solution.—It may be killed, and then some of the products resulting from its death may be dissolved, but this is a very different thing from dissolving living matter.”

Whether the actions of living things can or cannot be “explained by the properties of their bodies,” it is clear that their bodies have very different properties in the living state and after death.

Objections to
Beale.

In the dead state they possess solubility in the living state, not solubility, but a susceptibility of living.

Is it not rational to call this susceptibility of living by the term Vitality?

Dr. Lionel Beale wants to know when and how cer-

Note 4.
Beale.

tain beings become possessed of vitality, which would be as reasonable as to enquire why certain unorganized substances possess solubility, or are under favourable circumstances combustible.

Dr. Lionel Beale asks if the actions of living things depend on their vitality, where are those properties after death. I ask in return, what becomes of the solidity of ice when it is melted—of the liquidity of water when it is resolved into oxygen and hydrogen, or of the combustibility of alcohol after it is burned into carbonic acid, and watery vapour.

Rudolphi.

Rudolphi in the last century, said, "chemistry is able to investigate only the lifeless remains of organized beings." These remains of organized beings are as different from their former selves as alcohol is from carbonic acid and watery vapour.

When organism is destroyed, vitality ceases with it, and the composition of the formerly organized being is changed into a compound of common chemical elements. Vitality disappears to be replaced by common chemical affinity.

Beale.

Dr. Lionel Beale further says, "in these beautiful little organs, we see a motor and sensitive apparatus

exquisitely adjusted and comprised within very small compass."

Note 4.
Beale.

"Anyone who will contemplate such an arrangement of tissues as that which may be demonstrated in a specimen like the one figured, will not rest satisfied with attributing it to the 'properties' of the elements entering into the chemical composition of the substance out of which it has been made."

"The 'property' hypothesis accounts for absolutely nothing. Its advocates are unable to explain how one of the tissues has grown into the form it ultimately takes, how it acquired its structure, or how it came into relation with adjacent textures. No wonder the disciples of 'property' philosophy, pride themselves upon the interest they take in the broad general features, and try to make the public think that they have reason to look down upon minute details, and contemptuously disregard the facts demonstrated by those who study the structure of the bodies of living beings. The simple fool is he who knows that he does not know. The compound fool is he who does *not* know that he does not know."*

* *Protoplasm or Matter and Life*, 3rd Edit. of 1874, pp. 257 and 258.

Note 4.
Beale.

The explanation given by Dr. Lionel Beale is, that "the movement of all bioplasm is *vital*, occurs only during life, and is due to vital power."

"In man there seems evidence of the action of a higher and more wonderful vital power than exists in

Beale on
Properties.

Although at page 257, Dr. Lionel Beale is so strongly influenced against property, yet at page 278 he takes it under his protection as follows:—

"The bearing of the facts in connection with the movement, nutrition, and growth of living matter is unmistakable. They point to the existence of a *property* or power different in each particular kind of living matter," p. 275.

"A little transparent colourless material (in the amoeba) is the seat of these marvellous powers or *properties* by which the form, structure and function of the tissues and organs of all living things are determined," p. 276.

In this passage property is rehabilitated.

"Surely if Mr. Darwin may with propriety speak of the nature and *constitution* of the organism, I may be permitted to refer changes to the peculiar *nature*, *properties* and powers of the bioplasm," p. 293.

Here as in many other passages, Dr. Lionel Beale shows that peculiar changes may arise equally from the properties being peculiar as from the peculiarity of the powers which set in motion that acting material.

any living form.* This vital power is in fact the ego. Since all forms of vital power are transferable, is it not going farther than is warranted by reason to affirm, that no vital power can under any circumstance, be freed from the material, and yet be?"†

Note 4.
Beale.

As neither vital power, nor vital property, nor vital action have ever been observed free from their supporting matter, it is allowable at least to affirm that they have no existence distinct from substance.

"It is not possible to convey by words an accurate idea of the *power* which I suppose to be instrumental in determining the form and arrangement of the ultimate atoms of matter in a tissue or organ, I am ready to admit. But on the other hand, it is impossible to assent to the dogma, that all the facts of external nature known to us, and the facts of our own understanding, are to be explained by any known laws of physics and chemistry. He who will explain all the phenomena of living beings without resorting to the [Dr. L. Beale's] hypothesis of life, and the intervention of life-giving power, must in the first place make up his mind to disbelieve the evidences of his own senses, and determine not to use his reason aright."

* Page 318.

† *Ibid.*, p. 319.

Note 4.
Beale.

“It has been asserted again and again with the utmost confidence, that living matter is as incapable of moving of itself as is dead matter, but the assertion is inaccurate, for living matter may be seen by any one to move in the manner I have referred to. And it is scarcely incorrect to say that it moves of itself, because at this time no one can adequately explain the cause of the movement.*

A similar argument may be advanced for the independent motion of the water of a river—but we know that in each case a reduction of temperature below the freezing point puts an end to all movement, it is therefore inferred, that a certain amount of heat, and in the river of the force of gravity is requisite to call into play such actions.

“This tendency to move [on the application of the requisite stimuli] is one of the essential attributes of living matter.” The movement is quite *per se*, but it is characteristic of every form of living matter.”†

“The *cause*‡ of the movement of the non-living is outside it, and may be independent of it, while the cause of the movement of the living seems to be within it, and

* *Ibid.*, p. 269. † *Ibid.*, p. 271. ‡ Italics in the original.

to be of and belonging to the living matter as long as it moves. The development of the egg, it is said, is a *consequence* of the action of heat [and oxygen, &c.,] while in truth the heat is but an external condition, one of many attendant external circumstances, under which the marvellous phenomena of development proceed."*

Note 4.
Beale.

Any old hen-wife would convince Dr. Beale that the evidence for the hatching of eggs as a consequence of a certain degree of warmth was as convincing as the melting of ice from the same cause—to say nothing of the conveyance of the eggs of fish half round the world in ice—and their hatching when placed in warm water.

Objections.

"In truth when we enter upon the consideration of the *cause* of the changes in living matter, we get beyond the limits of observation and experiment. As the movement is peculiar, its cause must be peculiar, and it seems more reasonable to attribute this to some peculiar *power* manifested by living matter only."—Page 274.

Beale.

This argument is answered at page 55.

A careful perusal of Dr. Lionel Beale's writings has failed to discover any stronger arguments for the exis-

* *Ibid.*, p. 270.

Note 4.

tence of "a power, force or property, temporarily influencing matter, &c.," the cause of vital phenomena.

Cousin.

Cousin has shown that the very idea of cause implies that such cause must be a force or power external to, and apart from, the subject of that action which is attributed to the cause.*

* *Elements of Psychology* by Victor Cousin, translated by Cabel S. Henry, D.D., pages, 194, 195, 441, 442 and 443.

NOTE V.

BEALE'S ARGUMENT AGAINST PROF. HUXLEY'S PHYSICAL
DOCTRINES OF LIFE.

"OF the word-producing machinery and of setting it in motion. 'We desire,' says Prof. Huxley, 'the utterance of certain words: *we* touch the spring of the word machine and they are spoken. *Just as* Descartes' engineer, when he wanted a particular hydraulic machine to play, had only to turn a tap and what he wished was done.'"

Note 5.
Beale on
Huxley.

"But what and where is the *we* of Prof. Huxley? Where is the *spring* of his word machine? Where is its place, and how is it to be found? How came the word machine into being, and how was its spring formed? *Just like* the hydraulic machine of course; upon the same principles no doubt; only they were just a little modified."*

"The reader may be asked to consider the force of Prof. Huxley's *just as*, and whether the analogies are real or fictitious,—the analogy between the incorporeal

* *On Protoplasm, Matter and Life*, 3rd Edit., p. 82.

Note 5.
Beale on
Huxley.

'we' and the living working 'engineer,'—the analogy between the 'spring' of the 'word machine,' and the tap of the hydraulic apparatus, the analogy between the spoken words and the stream of water."*

"The Protoplasm of Huxley or Physical Basis of Life."

"In order to convince people that the actions of living beings are not due to any mysterious vitality, or vital force or power, but are in fact physical and chemical in their nature, Prof. Huxley gives to matter which is alive, to matter which is dead, and to matter whose properties are completely changed by being roasted or boiled, the very same name."

"Mutton contained protoplasm of the very same nature as was found in every living thing."

"The matter of sheep and mutton and man and eggs and lobster salad is exactly similar, and according to Prof. Huxley one may be *transubstantiated* into any other. But how? By 'subtle influences' and 'under sundry circumstances,' answers this authority. But is it not hard that the discoverer of 'subtle influences' should laugh at the fiction of *vitality*."†

* *Protoplasm, Matter and Life*, pp. 82 and 83. † *Ibid.*, p. 95.

“If a piece of meat, white of egg, roast mutton and boiled lobster, a learned Professor and his dog are all to be called protoplasm, we might call the matter of all animals and plants, dead or alive protoplasm. But surely it would be less incorrect to call roast mutton boiled lobster, the physical basis of death as the physical basis of ‘life.’ It is the physical basis of what was once alive, but”

Note 5.
Beale on
Huxley.

“All the king’s horses and all the king’s men
Could not put humpty dumpty up again.”

“And at last what is gained by calling the matter of roast mutton and living sheep, of a Professor’s brain, and a lobster salad by the same name? If the matter of the former is the physical basis of ‘life,’ one does not see how the latter can be so too, unless the roast mutton and living sheep are identical, unless the roast mutton and the lobster salad are still alive.”*

“The structural *peculiarities* of every living form results from vital peculiarities of the bioplasm which has taken part in its evolution.”†

Much more obviously the properties and peculiarities

* *Protoplasm, Matter and Life*, p. 99.

† Page 287.

Note 5.
Beale on
Huxley.

of everything, living or dead, results from its molecular constitution,* this constitution may result from its evolution, but that is a mere inference of the mind. We judge of matter by its properties, and we infer that the properties depend upon its intimate structure.

“Prof. Huxley has affirmed, that a particle of jelly *guides* forces.—‘He remarks, that to his mind it is a fact of the profoundest significance (!) that this particle of jelly is capable of *guiding* physical forces in such manner as gives rise to these exquisite and almost mathematically arranged structures, &c. [*Introduction to the Classification of Animals.*] But the Professor has not explained what he means by his phrase ‘guiding physical forces.’”†

Is it clear that physical forces can be *guided* at all by any material agent?‡

Dr. Lionel Beale adds:—“Concerning the dictum about jelly *guiding* physical forces, I venture to remark:”—

“1st. That living matter is not jelly.”

“2nd. That neither jelly nor matter is capable of *guiding or directing* forces of any kind.”

* Prof. Huxley, *Lay Sermons*, 151.

† *Protoplasm, Matter and Life*, p. 75.

‡ Note 8, on Force in Appendix.

“3rd. That the capacity of jelly to guide forces which Prof. Huxley asserts to be a fact of the profoundest significance to himself is not a *fact* at all, but merely an assertion, and of so vague a character as to be incomprehensible.”*

Note 5.
Beale on
Huxley.

Is it possible to imagine the force of gravitation being guided to act in a manner different from the laws it usually obeys?

* *Protoplasm*, p. 75.

NOTE VI.

NECESSITY OF PRECISION IN LANGUAGE.

John Locke on New Meanings of Old Words.

Note 6.
Locke.

LOCKE reflects on the application of old words in a new and unusual signification without defining them. "In this abuse the schools have been most remarkable, and have done philosophy the greatest injury. The absurdity of their doctrines necessarily led to this; for there is no more effectual way of defending strange and absurd doctrines, than to guard them round by legions of obscure, doubtful, and undefined words, which make these retreats more like the holes of foxes, or dens of robbers, than the fortresses of fair warriors; which, if it be hard to get them out of, it is not from the strength that is in them, but the briars, and thorns, and the obscurity of the thickets which beset them."

"Neither is there any ingenuity displayed in this abuse of language, no more than there would be in writing a book in which the signification of the letters of the alphabet should be changed A for B, and B for A, D for C, &c."

Richard Shute also remarks on the same subject:—

Note 6.
Shute.

“By all means, if you will, use every word in a sense that is not apprehended by the vulgar, and were you not the great philosophers that you are, I should say that you reminded me of nothing so much as of children who delight to interchange in the nursery, a gibberish which is not understood of their elders.”*

“What can be more absolutely necessary for accurate reasoning than a minutely precise limitation of the meaning of the words which we use. Such precision in argument is as necessary as is the accuracy of the engraver in the currency of bank notes. If no two persons attribute the same value, to the tokens which they use, how can any definite understanding be preserved.”†

Brit. and For.
Med. Chir.
Rev.

* *A Discourse on Truth*, by Richard Shute, p. 26.

† Critique by the *Brit. and For. Med.-Chir. Review*,—on *Neuralgia and Functional Nervous Disorders*, January, 1872, p. 117.

NOTE VII.

PROF. HUXLEY'S VAGUE USE OF WORDS.

Note 7.
Huxley.

PROF. Huxley uses scientific words in this uncertain manner and habitually confounds property, power, and function.

Prof. Huxley sometimes assumes that a *power* and a *faculty* are identical, at others he mentions that a property such as *contractility* of itself may give rise to motion, and again that vital actions are the *properties* of living matter and even the function of *Thought* is put down as a property of the material that thinks.*

"But I propose to demonstrate to you that, notwithstanding these apparent difficulties, a threefold unity, namely, a unity of *power or faculty*, a unity of form, and a unity of substantial composition, does pervade the whole living world."†

(In this passage power and faculty are treated as

Power and
Faculty.

* *Lay Sermons, Addresses and Reviews*, p. 160 of Edit. of 1870.

† *Physical Basis of Life*, p. 134.

identical and the word *unity* is employed to mean *similarity* in which sense the assertion is correct.)

Note 7.
Huxley.

“No very abstruse argumentation is needed, in the first place, to prove, that the *powers or faculties* of all kinds of living matter, diverse as they may be in degree, are substantially similar in kind.”

“The protoplasm of Algæ or Fungi becomes, under many circumstances, partially, or completely, freed from its woody case, and exhibits movements of its whole mass, or *is propelled by the contractility* of one or more hair-like prolongations of its body which are called vibratile Cilia.”*

(Here it is obvious the Professor means *contraction* by the word *contractility*, as mobility could never of itself cause motion, although on the application of a power motion would result).

“And so far as the conditions of the manifestation of the *phenomena of contractility* have yet been studied, they are the same for the plant as for the animal.”

(It is obvious, however, that *contractility*, any more than combustibility, can *manifest no phenomena*. We observe the phenomena of contraction or combustion, but

* *Ibid.*, p. 138.

Note 7.
Huxley.

the abstract qualities of contractibility and combustibility are mere inferences of our mind).

“It may seem a small thing to admit that the dull *vital actions* of a fungus, or a foraminifer, are the *properties* of their protoplasm, and are the direct results of the nature of the matter of which they are composed.”

(Here the functions of a living being are confounded with its properties).

“But if, as I have endeavoured to prove to you, their protoplasm is essentially *identical* with, and most readily converted into, that of any animal, I can discover no logical halting-place between the admission that such is the case, and the further concession that all vital action may, with equal propriety, be said to be the result of the molecular *forces* of the protoplasm which displays it.”*

(Here the word force is employed for property, an action depends upon the property of the acting body when excited by an external power. Force must be external to the object in action.)†

* Page 151, *Physical Basis of Life*.

† Other writers, however, as well as Prof. Huxley, confound the “quality of being active‡ with the state of acting”§—thus,

‡ Definition of Activity—Latham’s *Johnson*.

§ Definition of Action—*Ibid*.

Professor Huxley's use of the word *identical* is equally loose and uncertain (although upon that word a great portion of his argument depends).

Note 7.
Huxley.

Dr. Henry Power remarks:—"But the life of any complex organism is the aggregate of the Vital Activity (Actions) of all its component parts."

"No fact has been more clearly ascertained by modern (!) Physiological research than this, that the germ derives from its parent certain independent endowments [Vitality] in virtue of which it goes through its own course of vital *activity* [actions] and by the ultimate cessation of which its own term of existence is limited.*

Power.

Mr. H. Power also asserts that not only may "vital *activity* be sustained in a part separated from the body by the maintenance of the circulation of blood through it, but vital endowment which had ceased to *manifest* themselves may be restored."

How an endowment may be "lost and then afterwards restored" is not explained. It is certainly true that a property shows itself only when it is called into action, but it remains as an endowment equally with or without any outward manifestation.—(See note 12.)

Mr. Richard Shute in his discourse on Truth and Article, "Attempt at a more satisfactory Definition," in a similar manner, con-

Shute.

* Carpenter's *Physiology*, 6th Edit. 1864, p. 3, edited by Henry Power, M.B., and F.R.C.S.

Note 7.
Huxley on
Identity.

He asserts that the substance of various living bodies which may be miles apart is *identical*; but yet it is obvious that the properties of these different identical bodies may differ very greatly, as in the case of the inanimate material of the boiled lobster, and that of the thinking and speaking Professor.*

“These investigations have demonstrated the existence at great depths of the ocean of living animals, in some cases *identical* with, in others very similar to, those which are found fossilized in the white chalk. The Globigerinæ Cyatholiths in the one are absolutely *identical* with those in the other.”

“Identity—considering anything as existing, at any determinate time and place, we compare it with self-ex-

Shute.

finds activity with action. “By experience, we mean either sensations, *activities*, or emotions.”† Again he says, “I mean by mind that principle or power of which a man must be conscious with himself, by which he could perform like *Activities*.”

In these passages, mental actions are intended, for in what manner the “quality of being active” can be performed is not thinkable.

* *Critiques and Addresses*, p. 185.

† Page 15.

isting at another time and place, and thereupon, we form the ideas of identity and diversity" is the definition given by John Locke.*

Note 7.
Locke.

"The beard's th' identick beard you knew
The same numerically true."

Although Professor Huxley, as quoted by Beale, asserts that "Vitality can be neither weighed, measured, nor scientifically proved to exist," and is therefore a mere figment of the imagination, yet in his essay on the *Physical Basis of Life*, he virtually concedes the question.

By the "physical basis of life" he means to assert that there is some kind of matter common to all living beings.†

Physical basis
of Life.

"And if so it must be true in the same sense, and to the same extent, that the thoughts to which I am now giving utterance, and your thoughts regarding them are the *expression* of molecular changes of that matter of life which is the SOURCE of our other vital phenomena."‡

* *Human Understanding*, Chap. xxviii.

† "Metamorphosis into humanity Prof. Huxley had asserted just before that the protoplasm of the lobster was identical with himself, and yet now it requires to be 'metamorphosed' into humanity."

‡ Page 152, *Physical Basis of Life*.

Note 7.
Life.

By "matter of life" Professor Huxley means the essential matter of living animals, which matter or protoplasm is the subject, but certainly not the *source* of vital phenomena. A grain of wheat retains its protoplasm intact for a hundred or a thousand years, but displays its characteristic vital phenomena only when light, heat, and moisture, excite its inherent vitality into action. These external agents are the *sources* of the vital action.

"At any rate, the matter of *life* is a veritable *peau de chagrin*, and for every *vital act* it is somewhat the smaller. All work implies waste, and the work of *life* results, directly or indirectly, in the waste of protoplasm."*

"I might sup upon lobster, and the *matter of life* of the crustacean would undergo the same wonderful metamorphosis into humanity."†

"In *Critiques and Addresses* and in *Lay Sermons* by Prof. Huxley, the most important subject of discussion is "life," yet that word is not defined nor is its use at all determinate.

Generally by "life" he means living beings, but sometimes the capacity for living, at others living action after the definition of John Brown and his disciples.

* *Ibid.*, page 145.

† Page 146.

Prof. Huxley writes:—

Note 7.
Living beings.

“And through the twenty-five years that have passed, since the matter of “life” was first called protoplasm, a host of investigators.....have accumulated evidence..... in favour of that ‘immense unité de comcosition élémentaire dans tous les corps vivantes de la nature.’* In this passage it is evident that Prof. Huxley uses ‘life’ as synonymous with ‘les corps vivantes.’”

“To say, therefore, in the admitted absence of evidence, that I have any belief as to the mode in which the existing *forms of life* have originated would be using words in a wrong sense.”†

Forms of life must here mean various living beings, animal and vegetable.

Again, “the fluid becomes turbid and full of life,”‡ “the lowest forms of life”§ “the matter of life” and “forms of life”|| used in a similar manner.

For this use of the word, Prof. Huxley has some authority though it is more poetical than scientific—

* *Critiques and Addresses*, p. 87.

† *Critiques and Addresses*, p. 238 of Edit. 1873.

‡ *Ibid.*, p. 235. † *Ibid.*, p. 236.

|| *Lay Sermons*, p. 144, Edit. of 1870.

Note 7.
Life as
Vitality.

“Full nature swarms with Life.”*

and if he had always used the word in that sense, there would have been less ambiguity in his writings, but in other places he uses “life” as an abstract term for the capacity of living, or for living action.

At page 226.† “The proposition that ‘life’ may and does proceed from that which *has no life*, there was held alike by the philosophers, the poets, and the people of the most enlightened nations, eighteen hundred years ago.”

In the first part of this sentence, life means living beings, but in the second it is used in the abstract, either as a property of, or as the “sum of the actions of organized beings.”

At page 238,‡ Prof. Huxley concedes all that the Brunonian theory requires when he says:—“the conditions under which matter assumes the *properties we call vital*.”

If matter possesses vital properties it must have vitality—as the two expressions are grammatically synonymous.—See note from Latham in Appendix.

At the same place he also remarks:—

* Thomson.

† *Critiques and Addresses*.

‡ *Ibid*.

"I find no record of the commencement of 'life,' and therefore, I am devoid of any means of forming a definite conclusion as to the condition of *its* appearance."*

Note 7.
Life as
Vitality.

In this passage, "life" must mean either living beings, or the actions of such beings, as matter and motion alone present appearances. The pronoun pointing to impersonality, the natural meaning would be living action or existence.

At page 135, *Critiques and Addresses*, Prof. Huxley calls Biology the "science of life and living beings," it certainly is the first, but Zoology is the second. In this instance, however, Prof. Huxley uses the word life as an abstract term to signify the functions of organized beings, the peculiar subject of physiology.

In another place Prof. Huxley also uses "life" to signify living action or existence. "But the man of science, who forgetting the limits of philosophical enquiry, slides from the formulæ and symbols into what is commonly understood, as materialism, seems to me to place himself on the level with the mathematician, who should mistake the xs and ys, with which he works his problems for real entities, with this further disadvan-

* *Critiques and Addresses*, p. 238.

Note 7.
Life as Vital
Action.

tage.....that.....the errors of systematic materialism may paralyse the energies and destroy the beauty of a life.”*

As philosophers seldom have much beauty to suffer detriment, the word “life” may be taken for the course of conduct and not the person of the sage—and again, errors of belief could not affect the “properties we call vital,” nor even the “physical basis” of our philosophers.

When Prof. Huxley has no peculiar hypothesis to support, he uses the word living to signify continuous change or movement as by ordinary people, “for in some seams of coal, the courses of rivulets, which must have been living water, while the stratum in which their remains are found was still at the surface,” &c. &c.†

The analogy between life and motion, between living and continuously moving matter is most perfect—but if the water of the stream may figuratively be described as living, because its particles are in continuous movement, that motion may figuratively be called its life. The mobility of the particles of water are figuratively its

* *Lay Sermons, Physical Basis of Life*, p. 161.

† *Critiques and Addresses*, p. 102.

vitality, gravitation the power which acts on this susceptibility of living, and the life—the living motion—or perennial flow of the stream—is the result of their co-operation.

Note 7.
Life for living
action.

The water of the stagnant lake may be called dead, that of the running stream “living water,” in perfect analogy with all the laws of “life.”

NOTE VIII.

PHENOMENA AND FORCES.

Note 8.
Hime.

Abstract of a paper read at the last meeting of the Natural Science Section of the Sheffield Philosophical Society by the President, DR. HIME.

“THE profoundest investigation into the nature of matter ever leaves utter dissatisfaction in the human mind ; the finite thought, able to speculate on, and yearning to know the infinite, but ever driven back within the narrow limits which bound man’s mental. Whence did we get the idea of the infinite? we who can so little apprehend the finite. Even what actually comes under our observation can be known to us only relatively. Of ‘*things as they are*’ we know nothing; indeed much energy has been expended in discussing whether there is anything behind phenomena, any material substratum. False methods of inquiry, misuse of words, and religious intolerance, have greatly retarded the acquisition of knowledge throughout the world. The innate tendency to assign to super-human agency the cause of every unaccountable occurrence, and in general to invent *causes* when *conditions* only are known, readily leads men to be-

lieve that there are *forces* distinct from *matter*, *forces* which, operating on the '*brute matter*,' produce phenomena. But the idea of matter is a pure abstraction, and equally so is that of force. Physicial or material objects are known to us only through the medium of our senses. The PROPERTIES of matter are the POWER it possesses of producing certain sensations.* But there is no such thing as matter stripped of all its properties. To assume the existence of properties apart from the bodies which exhibit them is to endow an abstraction with existence. Of the causes of our sensations we know absolutely nothing, we have cognizance only of certain alterations produced within ourselves, or, as Kant puts it: 'What may be the nature of objects considered as things in themselves, and without reference to the receptivity of our sensibility, is quite unknown to us.'"

Note 8.
Forces pure
abstractions.

Kant.

As these words, Force, Power, Energy, are continually used by physiologists, it may be worth while to ascertain their meaning in the writings of mechanics.

S. Newth defines force to be "whatever is capable of producing motion in a body, or any change in the motion of a body is termed *force*. In other words, *force* is

Force.
S. Newth,
p. 23.

* Inherent properties are powers towards external objects.

Note 8.
S. Newth.

the name we employ to express that *unknown cause* which under any circumstances, can produce a change in the the state, whether of rest or motion of any material body. All statical forces may be measured by weight."

"The weight of a body is the total *force* with which that body is drawn towards the earth: it is therefore the same as the resultant of the *forces* which in consequence of the existence of gravity, act upon its small particles."*

Lardner also adds: Weight is a kind of *Force* with which we are most familiar.

All *forces* may be estimated by the amount of *weight* to which they are equal. *Mechanics*, p. 16.

A Property of one substance may become a Power towards another, and Lardner thus talks of the attracting power of the Earth. "The globe we inhabit participates in this common *property*. It therefore exercises an attraction on all bodies placed on or near its surface."

Lardner.

Again, he says, "the moving mass of a hammer head will exercise a *force* upon a nail sufficient to make it penetrate wood, an effect which no common pressure could produce."

Here it is obvious that a subjective property becomes

* Samuel Newth. *Mechanics*. 14th thousand, p. 23.

objectively a power, and therefore Mayer employs the word Power differently from writers on mechanics. Page 85, of *Mechanics*, by Lardner.

Note 8.
Whewell.

“Force is any cause which has motion or change of motion for its effect. Gravity is an uniform accelerating force, such an uniform force having this for its character, that it makes the velocity increase in exact proportion to the time of motion.”*

“Force is an abstract quality or property, by which one body affects the motion of another.”†

“We use the term Force to denote that property which is the cause of motion, produced, changed or prevented.”‡

“Force cannot exist without body on which it acts. The two conceptions of Force and Matter are co-existent and correlative. Force implies resistance, and the force is effective [obvious] only when the resistance is called into play.”§

“This conception of Force becomes so far distinct and precise, that it can be reasoned upon in a consistent manner, with demonstrated consequences,

* Whewell *History of Scientific Ideas*.

† *Ibid.* ‡ *Ibid.* p. 20. § *Ibid.* p. 207.

Note 8.
Whewell.

and a genuine science of mechanics comes into existence."*

Gull.

Should this be considered the meaning of the word Force:—to describe the "forces exhibited in animal functions as those previously *stored* up in plants" (Sir W. Gull) is unmeaning jargon, equally incomprehensible is the assertion, that "plants are the accumulators of the 'power' which animals distribute and disperse."

Huxley.

Lay Sermons, Huxley, p. 148.

* *History of Scientific Ideas*, W. Whewell, p. 206.

NOTE IX.

JOHN BROWN'S DOCTRINES.

To an old pupil of Dr. Fletcher of Edinburgh, the theory of John Brown appears as clear and simple as the thirty-second, Proposition, yet as a Professor of the University of Glasgow considers that "no two men whom he has met could give a clear account of the Brunonian doctrine," an effort will be made in this note to explain its nature and relation to medicine. Note 9.

In limine, although John Brown in his practice ordered stimulants in large quantities, yet his theory has no necessary relation to such treatment.

D. W. G. Gairdner in his address to the British Medical Association thus referred to John Brown's system of pathology.

"Now, one of the most remarkable facts in the history of the epoch of Cullen is one which might be made available in discussing, or in reflecting over, the signs of progress in the medical art to which he alluded. About a hundred years ago, when Cullen was at the height of his fame, the Chair of the Royal Medical Society was Gairdner.

Note 9.
Gairdner.

filled by a man who had been the pupil, the friend, almost the dependent, of Cullen, and who then and afterwards became his most bitter antagonist. He was not a man of large personal experience in the art of medicine; his learning and accomplishments were of a very limited kind; his private life and character were the reverse of laudable; his personal and social standing was in every point so much inferior to that of Cullen as to admit of no comparison. Yet this man, first in the Royal Medical Society among the younger students, and afterwards by a literary and doctrinal influence which extended in a wave of controversy to the very extremities of European civilisation, became the recognised author of a system which all but subverted that of Cullen for a time in Edinburgh, and, up to the end of the century, occupied the minds of men in Italy and Germany to an extent that we can hardly even comprehend now-a-days from anything we know of the system itself. I will almost take it upon me to affirm that there are not two men in this room—if indeed, there are so many in the whole British Medical Association (and I do not pretend to be one of the two)—who could at this moment give off-hand a reasonably clear account of the doctrine which was called Brunonianism, and of its application to the

Note
Gairdner.

leading varieties of disease and their treatment.* Yet it would be an inquiry fraught with the deepest interest to us, and I know none which would more effectually guage for us the progress of the art of medicine during these last hundred years, and thereby show us if we are in reality getting upon solider and surer foundations, then to ask ourselves whether, if some such man as this John Brown were to arise now and to broach such a system as he advocated in 1775, it would have a shorter life, and be less revolutionary in its effects. I cannot enter upon that question to-day; I cannot even talk to you, however briefly, of the respective merits of Cullen's and of Brown's teaching; but I happened, in looking over a few books on the subject yesterday, to light upon an actual and apparently authentic prescription of John Brown's, preserved for us by one of his pupils; or rather, perhaps, let us call it the net result of his system conveyed in written advice to a *hypochondriac* patient as follows. I think you will recognise in it something not unlike what we have seen and known in our own time.

“For breakfast, toast and rich soup made on a slow fire; a walk before breakfast and a good deal after it. J. Brown.

* See Note 11, Writers on Life.

Note 9.
J. Brown.

A glass of wine in the forenoon from time to time. Good broth or soup to dinner, with meat of any kind he likes, but always the most nourishing. Several glasses of port or punch to be taken after dinner, till some enlivening effect is produced from them; and a dram (of whiskey?) after everything heavy. One hour and a half after dinner, another walk. Between tea-time and supper, a game with cheerful company at cards or any other play, never too prolonged; a little light reading; jocose humorous company, avoiding that of popular Presbyterian ministers and their admirers, and all hypocrites and thieves of every description. Lastly, the company of amiable, handsome, and delightful young women, and an enlivening glass."

Gairdner.

"I think that from this prescription we can obtain a pretty good idea what was the nature, or at least the upshot, of the famous Brunonian system, the end and issue of all those lectures and expositions upon direct and indirect debility, and upon excitability, which formed the key-stone at once of Brown's doctrine and of his practice. It is a very curious proof how things go to sleep and are revived again, that we should have seen a practice, not, indeed, based upon the same theory, but very like this in its processes within our own time, even with-

in these few years, to such an extent as to have led to a formal declaration against it by many of our most distinguished physicians. I can testify for one that people have come to me repeatedly who had been formally advised, very much after the manner of John Brown, to take, say, four or five, or more, glasses of port wine after dinner and after that as much toddy as their heads could carry, and this as part of a regular prescription going on for weeks together. But, if anyone should ask, could such a practice, however indulgent to the weaknesses and follies of self-indulgent people, be successful in our day in floating such a general theory of disease and cure as the Brunonian system? I should incline to reply in the negative; and I should rely on giving that answer not only upon the great advances that have been made in physiology and pathology, the sciences upon which all genuine improvement in the medical art is founded, but also upon the much more exact and complete methods of clinical observation pursued in the present day, even as compared with the time of Cullen. I refer especially, of course, to the methods taught to the average general practitioner in our schools; for no one would wish to deny that we have had great and true,

Note 7.
Gairdner.

Note 9.
Gairdner.

may, eminently exact, clinical observers in the past, even in the remotest ages.”*

That this treatment of a hypochondriac is not peculiar to John Brown, and that it does not result from his doctrines alone, may be seen from a similar instruction of an able man of the present day. Dr. Blandford advises the following treatment in similar cases.

Blandford.

“To patients (monomaniacs) who refuse their food because of dyspepsia—with foul coated tongue, foetid breadth and loaded bowels. This is the kind of diet I have given.

Before getting out of bed in the morning rum and milk or egg and sherry—breakfast of meat, eggs and café au lait.

At eleven o'clock beef tea and a glass of port. A good lunch at two with two glasses of sherry.†

At four beef tea or broth.

* An address delivered at the opening of the section of medicine, at the Annual Meeting of the British Medical Association, in Edinburgh, August 1875. By W. T. Gairdner, M.D., F.R.C.P.Ed., Professor of Medicine in the University of Glasgow; Vice-President of the Section.—*The British Medical Journal*, August, 14, 1875.

† Blandford on *Insanity*, p. 192, edit. of 1871.

At seven dinner, with stout and port wine, at bed-time stout or ale with the chloral or morphia.

Note 9.
Blandford.

Improvement has taken place *immediately*."

Although the mere statement of John Brown's theory carries conviction of its truth, yet its meaning is often misunderstood from the terms he employed conveying varying ideas to the minds of different persons.

An attempt will here be made to render his theory clear by an analogy.

A ship sailing on the sea excites in our minds many ideas distinct from the vessel herself. We first observe her motion, which implies the property of mobility, and some power to produce this motion, viz., the wind.

We infer that this power acts upon this property of mobility to produce the motion.

Then we form an idea of the result of this motion—a change of position and a certain amount of wear and tear.

Thus, the property, the power, the motion, and the result, are relations involving ideas, distinct from the ship itself, which alone of these terms implies a material object.

In a similar way, vitality, external powers, function or life are relations involving ideas distinct from the material living organism.

Note 9.
Analogies of
Life.

A still better analogy is the nature of a river..... We observe its flow, and we infer from this movement the possession by every particle of mobility; we also suppose the existence of some power external to the river to cause this continued motion, viz., the force of gravitation. We also observe a certain amount of wear of the banks, and the deposit of sediment in a new position.

To add to the resemblance in these points, the river is continually receiving fresh particles of material at its source, and discharging an equal amount into the ocean.

The ideas of mobility, of gravitating power—as well as of motion, and the results of such motion are each distinct from the river itself. Our ideas of these relations are clear and definite, although no separate existence is imagined.

The ship and river are perceived by the senses, but the inherent property, the external power, and the resulting motion, are mere inferences of the mind.

The mobility of the ship or river is analogous to the vitality of an organized being, the forces which excite this mobility, to the external powers which excite the vitality of the living creature, and the resulting motion of the ship or river is their life.

Motion and life are strictly analogous. All the move-

ments of an organized being, molecular or massive, are included in this term life.

Note 9.
Analogy of
Motion and
Life.

Although the wind and the earth appear to act directly upon the ship and the river—such is obviously not the case. It is an inherent property of the wind to press upon, and of the earth to attract all matter towards its centre.

The property of one body becomes therefore, a force to another external to itself.

Also as motion is merely a condition of matter and not itself an object, neither of its factors can be material—neither the mobility nor the forces which act upon that property, but are merely relations of material objects.*

Life also is merely a condition of matter, and, therefore, neither the vitality of organized beings, nor the external powers which call into action this vitality are material, but each as in the former case, mere relations of material objects.

Vitality by John Brown is called irritability.—He considers all organized tissue to be irritable or susceptible of living.

* Locke, book, ii, cap. 25.

Note 9.
Analogy of
Motion and
Life.

He does not employ that term to designate a morbid condition. Also he describes life as a forced state*—just as the motion of a ship is a forced state—without the force of the wind, the ship could not move. An organized being without its ordinary stimuli, light, heat, electricity, air and aliment equally remains without molecular or visible movement.

In disease there is diminished local excitement,† and therefore, all diseases are cured by stimulants.

All positive agents must act as stimuli or as excitors of the diseased part.

That all ordinary remedies are stimulants is proved by their action on the surface of the eye where their effects can be observed.

The only sedative or depressing agents allowed by John Brown are the privation of stimuli, or as commonly called negative agents, viz., cold, darkness, privation of oxygen, of food, of drink, of the pressure of the atmos-

* As by Wilson Philip—*Essay on Sleep and Death in Phil. Trans.*, 1835.

† John Brown. *Elements of Medicine*, Cap. 2, p. 39.
Fletcher's *Pathology*, p. 161.

phere, and abstraction of blood; or generally the withdrawal of any of the ordinary stimuli to vital action.*

Note 9.
Analogy of
Motion and
Life.

* John Brown's *Doctrines of Pathology* can only be alluded to in this place, but it is explained and enlarged upon in Fletcher's *Elements of Pathology*.

NOTE X.

AUTHORS ON THE VITAL PRINCIPLE.

(From *Fletcher's Physiology*, part 11, p. 18, pub. 1837.)

Note 10.

THAT Life is an *Ουσία*, an Entity or a Substance, material or immaterial, resident in certain aggregations of matter, and the cause both of its organization, and of the characteristic actions which it afterwards performs, is the oldest opinion on the subject, having been entertained by almost all the ancient sects of philosophers. The notion of the existence of an Elementary Fire—the Soul of the world, the formative and conservative Power of all nature—descended from the Brahmins of India, through the renowned Hermes Trismegistus, or Tot of glorious memory, and the Pastophori of ancient Egypt to Thales and Pythagoras, the former of whom studied at Memphis, and subsequently taught philosophy at Miletus, while the latter studied at Thebes, and taught afterwards at Crotona. It thus became the tenet of the numerous schools which, in later times, flourished in Greece and Italy—the Academic under Plato, the Peripatetic under Aristotle, the Stoic under Chrysippus, and

Trismegistus.

so forth. By the “learned Theban,” indeed, this $\Pi\tilde{\upsilon}\rho$ καθάρσιον of the Egyptians had its name changed to Φύσις, while by Plato it was called for the first time $\Psiυχ\grave{\eta}$, by Aristotle Εντελέχεια , and by Chrysippus $\Piνεῦμα$. Nor were the opinions of these and other celebrated philosophers, respecting the nature of this imaginary substance, less discordant than the names which they imposed upon it; some looking upon it, like the original propagators of the doctrine, as a kind of Fire, others as a kind of Air, or Ether, or Spirit—the Breath of life, &c.,—and others again as merely a kind of Water (*Ciceronis Tusc. Quæst. lib. i. § 9, 10*). But, whatever were its nature, this supposed substance actuating, as was believed, the Macrocosm or universe, of which it regulated all the motions in the capacity of Life or Soul of the world, was capable of being split or divided into innumerable portions, so that each individual Microcosm or organized being got a chip of it—a *Divinæ particula auræ*—and this, in quality of its proper Life, in like manner actuated and directed all its proceedings. This idea of the Vital Principle, in its character of Fire, has been immortalized by the story of Prometheus, who is said by the poets to have vivified his clay statues by a fragment of it stolen from the chariot of the sun; and a similar notion was em-

Note 10.
Aristotle.

Plato.

Prometheus.

Note 10.
Hippocrates.

Galen.

Vital Principle
and fire.

braced by all the early physicians. Thus by Hippocrates the human body is described as consisting, not merely of *ισχοντα* and *ισχομενα*, of which notice has been taken already, but of *ἐνορμουντα* also, which seems to signify nearly the same thing, or the same nothing, as any one of the terms above specified—so much so, that Galen subsequently again employed, instead of it, the term *πνευματα*, from Chrysippus. These *πνευματα*, he split, as lately mentioned, into three families, under the names respectively of Vital, Natural and Animal Spirits, to each of which he gave, as well as a “name,” a “local habitation”—the first being placed in the heart, the second in the liver, and the last in the brain; and thus conferred a most essential favour on the subsequent physiologists of the Vital Principle school, by supplying them with a most convenient *Θεὸν ἀπὸ μηχανῆς*, to be always conjured up when any difficulty was to be explained, or at least disposed of. In this way then Life came to be regarded as a substantial Existence, like that coarser kind of Fire which was one of the four reputed elements of all things; and as the latter, when it entered into bodies, was represented as the cause, as well of their general physical properties, as of the peculiar phenomena which they displayed during combustion, so the

former, on becoming a denizen thereof, was described as the cause, first of their organization, and afterwards of the peculiar actions by which, when so organized, they were distinguished. And this view of the matter was perhaps the most natural to Man in the infancy of Philosophy, impressed as he was, from the first, with the idea that all matter—at least all the grosser forms of it—were essentially inert, and of course disposed therefore as he was, to ascribe all spontaneous motion to a union with the thing moved of some substantial moving cause. It was not easy even for the most exalted geniuses, with so limited a knowledge as they then possessed of the essentially different properties resulting from differences in the composition, substance and aggregation of different forms of matter, to do otherwise than attribute the distinctive actions of organized beings to some hidden Principle operating within them, of which inorganized matters were destitute; but it might have been expected that such vague surmises as this would long before this time have sunk under a more enlightened Philosophy, and that Life as a substance would long since have shared the same fate as Fire as an element. Such however, has not been the case, the notion that Life and living action are quite distinct, the former being the sub-

Note 10.
Vital Principle.

Note 10.
Writers on
Vital Prin-
ciple.

stantial cause of the latter, having descended from the authors above enumerated, through Van Helmont, Harvey, Borelli, Perrault, Stahl, Carl, Coschwitz, Swammerdam, Whytt, Sauvages, Bordeu and Barthez, to Plenck, Platner, Hufeland, Sprengel, Schmidt, and other writers of the close of the last century. From these it has been transmitted unadulterated by Abernethy, Lamarck, Pring, Barclay, Good, Davies, Bell, Prout, Kirby and others, down to our own time;* and we are still condemned to hear the terms Vital Spark, Vital Spirit, Vital Principle and so forth continually used, not only by the vulgar, but by philosophers of eminence, as referring to something which has confessedly a real and substantial existence, and the human body is still sometimes described as consisting of solids, fluids and a Vital Principle, almost in the same words as were employed between two and three thousand years ago by Hippocrates. Of course the said Principle has acquired in its progress some new names, as in the hands of Van

Van Helmont.

Helmont, who, as he could not of course use any term which had been employed by Galen, called it Archæus, a term borrowed from Paracelsus; and, instead of being shorn of any of its blushing honours, has even been

* 1837.

invested with higher attributes than of yore, as in the hands of Stahl, who very much extended the powers of the ancient $\psi\upsilon\chi\eta$ or Anima, to which term he had, after Harvey, returned. The term Vital Principle originated with Barthez, and was invented to signify something distinct from either mind or body, but nevertheless in all probability subsisting by itself, although he confessed that he could not determine “whether it were a substance, or only a mode of the living body.” Whytt has been called a semi-animist—a half-stahlian. Barthez may perhaps with equal propriety be called a semi-substantialist—a kind of stepping-stone between the Entity and Non-entity schools. John Hunter was perhaps the first to identify the Vital Principle with Electricity or Galvanism. It has been denied by some that John Hunter was really one of the Subtle fluid persuasion (*Ann. of Med. and Surg.*, 1817—*Lawrence’s Lect. on the Physiology of Man*, 1819) and it is quite certain that his “Materia Vitæ,” which was the solid nervous substance, was nothing of this etherial nature. But this was with him only the material domicile of Life, not Life itself, which, in as far as he identified or associated with Galvanism, he certainly made a fluid of the nature above described. With respect to the modifications of

Note 10.

Barthez.

John Hunter:

Note 10.

Abernethy.

Lamarck.

Pring.

the doctrine which maintains the existence of Life as a substance by those who have most recently written on the subject—and it seems quite superfluous to go further back than the present century—Mr. Abernethy, who treads everywhere so closely in the footsteps of John Hunter, believes of course that Life is, if not identical with, certainly analogous to, Electricity or Galvanism (*On Mr. Hunter's Theory of Life*, 1814); but the refutation of this unfortunate hypothesis may be advantageously deferred till the subject of Electricity or Galvanism, as a stimulus to irritability, falls to be considered: in the mean time it is sufficient to say of it, that anything more vague and visionary has never hitherto obstructed the progress of physiological science. Of the same stamp is the hypothesis of Lamarck, that Life is a compound of Electricity and Light. By Dr. Pring on the contrary the Vital Principle is represented as a substance quite *sui generis*, and he speaks of a “sum and quantum of Life,” with as much confidence as if it could be meted out by the help of a pair of scales, or a glass measure;* while it is an inference from his hypothesis, that, as Life

* A similar opinion is enunciated by Prof. Huxley, *Physical Basis of Life*, p. 145, and note 13 in appendix.

is on the one hand a cause of organization, so organism is on the other a cause of Life, since the substance of Life is continually renewed, he assures us, "by the assimilation of its identity from the blood" (*On the Laws of Organic Life*, 1819). But if the substance of Life be renewed from the blood, it must either have entered the blood in propria persona with the food, in which case the said food ought to be alive, or it must have been formed by the blood, in the manner of a secretion: and from what ingredient of the blood secretion can produce *de novo* a simple substance, material or immaterial, remains to be explained. But perhaps the substance of Life is not simple—and indeed we are told that "the influence of Life is to separate from the blood those elements which constitute its own identity;" and elsewhere, that "animal heat is a part of the principle of Life." *Elements and parts of a Principle—material ingredients* of that which even those who look upon it as substantial still generally considered as *immaterial*! But it is mere waste of time discussing such "verba et voces prætereaque nihil" as these. Dr. Barclay's work (*On Life and Organization*, 1822), extolled, as it has of course been, by those who advocate similar opinions, consists not so much of a statement of arguments in favour of

Note 10.

Barclay.

Note 10.
Barclay.

the existence of Life as a substance, as of a parade of authorities on the question whether Life be the result of organism, or organization be the result of Life—a question only indirectly connected with the one at issue, since, although most of those who contend for the existence of Life as an entity adopt the latter opinion, there are some of them, as elsewhere observed, who still imagine, like all those who deny this existence, that organization is independent thereof, and believe that Life does not enter the being till its organization has been effected. Dr. Barclay is not one of these; but presuming on the existence from the first of a substantial Principle, which may be called indiscriminately Vital, Sensitive, Rational or Immortal—a most unfortunate but not very unusual jumble—he indulges in a tirade of somewhat captious abuse of the head and heart of everybody—in particular of Blumenbach, Cuvier, Cabanis and Lawrence—who presume to differ from him, and whose tenets he vaguely conceives likely to interfere with “the raptures of Moses and the Lamb” (p. 399). Dr. Barclay was an excellent anatomist and an excellent man; but as good anatomists and as good men as he, have entertained, and still entertain, very different sentiments on these matters. In the same track follows

Dr. Mason Good—a name hardly less notorious in physiology, than eminent in literature—who, in ridicule of the doctrine that Life has no real existence, which had become by this time rather inconveniently prevalent, facetiously remarks, “the human frame is hence a barrel organ, possessing a systematic arrangement of parts, played upon by peculiar powers, and executing particular pieces or purposes, and Life is the music produced by the general assemblage or result of the harmonious action” (*Study of Medicine*, 1825, vol. iv. p. 44). He could not possibly have illustrated the nature of Life, consisting as it does in the proper actions of *organ-ized* beings more happily—“We thank thee, Jew, for teaching us that word.” Dr. Pring instructs us only how the substance of Life is continually renewed; but Mr. Davies in some otherwise excellent papers in a medical journal teaches us how it is subsequently disposed of, assuring us that “it combines with the structure by means of affinity, as well as forms that structure by the same power,” (*London Medical Repository*, 1827), a circumstance which it must be extremely gratifying to everybody to be aware of, particularly as it is so satisfactorily demonstrated. Dr. Alison in his recent work avoids, perhaps judiciously, entering into any discussion re-

Note 10.
Mason Good.

Davies.

Note 10.
Alison.

specting the nature of Life; a word which "does not," he inadvertently observes, "denote a simple idea, and therefore cannot be defined" (*Outlines of Physiology*, 1831, p. 1), a diametrically opposite reason being offered with more propriety a little further on (p. 151) for not attempting a definition of sensation or thought. He is obviously inclined however, to regard Life, not indeed as anything material, but still as an entity, since he describes organization as one of its effects; and accordingly we find his reviewer stating, in opposition to the more modern opinions concerning the nature of Life, that "it is a sad confusion of all etiological relations, which ascribes to the passive and naked effect the very existence of the agent to which this effect owes its being" (*Medico-Chir. Rev.*, 1831). Still more recently also Mr. Thomas, in allusion to the same doctrines, has observed, "We have first the effect, and secondly the sum total of the effect entering into an unnatural conspiracy to produce, by an ex-post-facto operation, a cause for an antecedent operation" (*Liverpool Med. Gazette*, 1833). Now this is precisely what we *have* in the entity view, and what we *have not* in the non-entity view of the matter in question; for in the former we have first Life ψυχὴ represented as forming the structure, and then the

Thomas.

structure represented as forming Life ($\psi\chi\eta$) whereas in the latter, Life is admitted as an effect alone—as a $Z\omega\eta$ and it is only therefore upon the unjustifiable petitio principii that life exists as a $\psi\chi\eta$ —the q. e. d.—the very point at issue that these objections are founded. There needs no ghost come from the dead to tell us that an effect cannot be the cause by which that effect was produced; but had the opponents of the latter view of the matter understood the doctrine which they impugn, they would have known that Life is regarded by the advocates of this doctrine, not as a cause of vital action, but as identical with it, the cause being the co-operation of a certain property and certain powers, both quite distinct from Life in either sense of the word. Sir Charles Bell, Dr. Prout and Mr. Kirby (*Bridgewater Treatises*, 1834) are among the latest authors who have contended for the existence of a substantial Life, but they have adduced none but the usual arguments in its favour; and the last is more than usually mystical upon the subject. Upon the whole, that there is any evidence whatever of the existence of Life as an Entity, those who maintain the opposite opinion are satisfied with denying, the onus probandi resting of course with those who support the proposition. It might otherwise be shown that the

Note 10.

Charles Bell.

Note 10.

admission of this hypothesis brings with it many more difficulties than it removes; and that innumerable phenomena, which are easily explained without it, become quite inexplicable if it be admitted: but it is idle making giants merely for the purpose of killing them. It may appear, and indeed it has been lately remarked by Dr. Clark (*Report on Animal Physiology, read to the British Association at Edinburgh, 1834*), that the views of most of the authors above cited from Aristotle downwards are in fact nearly the same as those at present generally entertained, and that if we substitute the word Property for Principle, and the word Vitality for Life, there is no essential difference between the two. It must be remembered however, that in the more modern view of the matter this property is never regarded as *substantial*, nor ever as *per se sufficient* for the display of vital phenomena—points, which appear quite sufficient to constitute a fundamental difference between the two. The acrimony with which the contest has been sometimes maintained might be supposed to furnish of itself sufficient proof that the opinions entertained were not at all reconcileable, did we not know that the most acrimonious disputes have frequently been those in which the question

was *de verbo*, and not *de re*—but this is not the case in the present instance.”* Note 10.

Mr. John Marshall in his *Physiology*, published in 1867, although he always treats vitality and contractility as properties of organized matter, and although he considers that these properties are called into action by the ordinary force, or forces of nature, yet the “shaping” of “protoplasm into a perfect cell or gymnoplast implies the presence of some further *controlling power*. There would seem to be some *special force* in animals and plants by which their tissues are *endowed with their ordinary properties*, and by which moreover entire organisms are developed in endless variation. John Marshall.

“These phenomena imply the presence of a guiding, controlling and dictating *force*, transmissible from generation to generation, and certainly distinct from, though co-operating with, the common physical force of nature. This is truly a *vital force*—a force properly called organic—on which the very existence of both animal and vegetable organisms depends. It is this force, also known as the ‘germ force,’ which develops and maintains the body

* Fletcher’s *Physiology*, part 2, p. 18 of edit. 1837.

Note 10.
John Marshall.

and all its parts, and imparts to them even their very highest endowments.”*

“This guiding and controlling force transmissible from generation to generation,” has all the characteristics of the Vital Principle though under another name.

Paget.

Sir James Paget† also speaks of “a formative or vital force, by which the energy in food is directed in transforming the matter of food.

“This force in the adult is (he says) the same which actuated the formation of the original tissues in the development of the embryo—this vital or formative force is in constant operation, and under its direction, certain actions go on,” just as described by the upholders of the Vital Principle.

Lucas.

Much in the same way at the meeting of the Brit. Med. Association, 1875, with Dr. Burdon Sanderson in the chair, Mr. Thomas P. Lucas read a paper on “nerve force” and expressed an opinion that “Vitality is dependent upon an exhibition of this force,” just as though a chemist had described combustibility to be dependent upon an *exhibition* of the force of heat.

* Page 107, vol. i., 1867.

† *Lectures on Surgical Pathology*, 3rd edit., 1870, p. 46.

“ ‘The complimentary nerve force’ is that which is called forth and discharged in the exhibition of every vital phenomenon.”*

Note 10.

At the same meeting, Dr. John Cleland, in an address to the Association, lays it down that “the doctrine of natural selection starts with the recognition of an *internal formative force* which is hereditary.....and further it will be observed that one of the fundamentals of the doctrine, is that the formative force ALTERS ITS CHARACTER gradually and permanently when traced from generation to generation in great tracts of time.”

Cleland.

A force which alters its own character, and presumably improves it, must at least be an Entity, and have the best qualities of the vital principle.

Dr. Cleland continues:—“We are therefore presented with a formative *force* which exhibited itself in very simple trains of phenomena in the first beginnings of life, and now is manifested in governing the complex growth of the highest forms. We are set face to face with that formative *force* and are obliged to admit its inherent capability of changing its action; and that being the case, it is more of an assumption to declare that the

* *Brit. Med. Journal*, 28 Aug., 1875.

Note 10.

changes are all accidental and made permanent by accident of external circumstances, or to consider that it has been the law proper to this *force* to have been adequate to raise forms—from the simple to the complex,—precisely as it acts in the evolution of a simple egg into an adult individual. This is that formative *force* which has been elaborately shown by Mr. Darwin, in launching his theory of pangenesis, not only to be conveyed through whole organisms and their seed, but to pervade at all times the minutest particles of each.”*

Darwin.

* An address on the present state of Anatomical Science—delivered at the Anatomical and Physiological Department of Biological Section of the British Association, Bristol, Aug. 25, 1875. *Brit. Med. Journal*, Sept. 4, 1875, p. 289, by John Cleland, M.D., F.R.S., Professor of Anatomy, &c. &c.

NOTE XI.

AUTHORS ON LIFE.

(From Fletcher's Physiology, part 2, p. 35—showing that the word Life cannot be properly used to signify a property such as vitality, nor yet a power, nor a substance, but only a series of actions.)

SOME faint glimmerings of the true nature of Life had, from time to time, broken in upon physiologists, even during the long period that the Vital Principle doctrines remained formally unquestioned; and it was as illumined by one of these that Mead compared the living body to a machine, endowed with the property of perpetual motion, "owing to its parts being so disposed that, while they perform their respective functions, they constantly and mutually repaired each other." That Life consisted in this motion, however, had never hitherto been explicitly taught; nor was it till long after the essential condition of this motion, namely irritability, or vitality, had been discovered, and the laws which it obeys had been established with considerable precision, that it began to be inculcated that it was in the phenomena resulting from the constant co-operation of this

Note 11.
Nature of Life.

Mead.

Note 11.

John Brown,
1780.Stoics.
Epicureans.
Dr. Priestley.John Brown's
Doctrine.

property, and the stimuli which act upon it, that Life consisted. Perhaps it was at the hands of John Brown—low as was his condition, vagabond as were his habits, erroneous as were in many respects his views, pernicious as was his practice, and scorned and reviled as is for the most part his memory—that the “Vital spark of heavenly flame,” of which we have been speaking, received its first blow, and a degree of closeness and precision was introduced into physiological and pathological reasonings, of which, so long as men had the free use of this *Deus in fabula*, such reasonings must be destitute. It was he who distinctly showed for the first time, about the year 1780, that Life as a $\Psi\upsilon\chi\eta$ or Anima, did not exist, being neither matter itself, as the Stoics and Epicureans among the ancients, and Dr. Priestley among the moderns, had supposed, nor an immaterial substance added to matter, as almost all the rest of the ancients, and so many of the moderns, had imagined; but that, as a *Zwē* or Vita, it consisted merely in a series of motions performed by organized beings, and resulting from the action of certain exciting powers attached to matter, on a certain susceptibility in other matter of being excited. “In all states of life,” says Brown, “Man and other animals differ from themselves in their dead state, or from any

other inanimate matter, in this faculty alone, that they can be affected by external agents, as well as by certain functions peculiar to themselves, in such a manner that the phenomena peculiar to the living state can be produced" (*Elements of Medicine*, 1788, vol. i. ch. 2). The whole merit of Brown however, consisted in his including the necessity of a second condition—that of the constant co-operation of stimuli to the phenomena of Life; since he was, in one view of the matter, a confirmed substantialist, denying indeed the existence of *Life* as an entity, but everywhere speaking of *Excitability* or *Vitality* in that character. It is unnecessary to say how eagerly this view of Brown's was taken up, and how extensive an influence it had upon the pathological doctrines of his day; nor was it long in making its way among physiologists also.* Among the first to adopt it was the venerable Blumenbach of Gottingen, who, although he has always continued, like many others of the same way of thinking, to use the word *Vital Principle*, still constantly speaks of it, not as a substance but as a property—so that the term becomes synonymous in his hands, as the term *Life* unfortunately is in those of his

Note 11.

Blumenbach.

* See note 9—Dr. Gairdner's oration, p. 163.

Note 11.
Elliotson.

translator, Dr. Elliotson, with Irritability or Vitality—and explicitly asserts that no such actions as constitute Life can take place except when this property is acted upon by the requisite stimuli (*Institut. Physiol.* 1786, sect. 4). Similar doctrines were promulgated soon after-

Soemmering.
Reil.

wards by Soemmering and Reil, the latter of whom describes Vitality as the effect of the form and constitution of matter, and Life as this property in action (*Archiv. für die Physiologie*, 1796); and they began,

Cuvier.

about the same time, to be taught in France by Baron Cuvier and Bichât. According to Cuvier—a name still deservedly in the highest repute, not less in physiology than in anatomy, notwithstanding the vituperation of his logic by Dr. Barclay, and the charge of hebetude latterly preferred against him by Geoffrey St. Hilaire—Life consists in “l’ensemble, des phénomènes qui ont donné lieu à sa formation;” and he well remarks, that to define it with precision is to run over in detail all the characteristic actions of living beings (*Leçons d’Anat. Comp.*, 1799).

Bichât.

Bichât again describes it, in exactly the same acceptation, as “l’ensemble des fonctions”—unfortunately adding however “qui résistent à la Mort”—unfortunately, because these words, if they were intended to imply that death is anything substantial, are absurd,

if only that it is the cessation of Life, superfluous (*Anat. Gén.* 1801, and *Sur la Vie et la Mort*, 1802). According to Richerand “on appelle du nom de Vie une collection de phénomènes qui se succèdent, pendant un temps limité, dans les corps organisés;” and he further remarks that all the misconceptions concerning the nature of Life “tiennent à ce que, ne voulant pas la considérer comme un simple résultat, les physiologistes l’ont perpétuellement confondue avec les propriétés vitales” (*El. de Physiol.*, 1804, p. 1). The same view of the matter was taken by Cabanis; according to whom, “Vivre n’est autre chose que recevoir des impressions, et exécuter les mouvements que ces impressions sollicitent” (*Rapports du Physique et du Moral de l’Homme*, 1805, tom. ii., p. 137); and although he also speaks of a Vivifying Principle or faculty, namely Irritability or Vitality, as “la condition sans laquelle les phénomènes, propres aux différens corps organisés ne sauroient avoir lieu,” distinctly adds “Je suis surtout bien loin de vouloir conclure affirmativement de ces phénomènes l’existence d’un Etre particulier, remplissant la fonction de Principe, et communiquant au corps les propriétés dont leur fonctions résultent” (Tom. i., p. 245). In the mean time the same tenets were taken up in Italy, among others,

Note 11.

Richerand.

Cabanis.

Note 11.
Rolando.

by Rolando (*Sur la cause d'ou depend la Vie*, 1807) who beautifully describes Life as "le complement des fonctions," and consequently "un état forcé," they were further maintained in Germany, among many others, by Prochaska and Hildebrandt; and shortly afterwards were adopted by Mr. Lawrence, who was the first to present them in their properly physiological aspect—for by Brown the application of these doctrines had been principally pathological and therapeutical—to the physiologists of this country. Lawrence speaks of the substantial Vital Principle as hastening fast, at the time at which he wrote, to "the vault of all the Capulets;" and, following very closely Blumenbach, Cuvier and Bichât, represents Life as "consisting in the assemblage of all the functions or purposes of organized bodies, and the general result of their exercise" (*Int. to Comp. Anaty.*, 1816, p. 120), a definition which gave rise to the facetious comparison, already spoken of, by Mason Good of the human frame to a barrel organ. These doctrines of Mr. Lawrence owing to some extraneous leaven with which they were unhappily and very unnecessarily mixed, but which needs not be particularly noticed in this place, were for some time anything but popular in Great Britain; but they were nevertheless adopted, with

Hildebrandt.

Lawrence.

some mitigations, by Burns, Gordon, Allen and others, and, not only unmitigated, but in rather an aggravated form, by Sir Charles Morgan. Like his predecessors in the same field, he defines Life to consist in "the sum total of functions which any individual can perform;" but, unlike them, he denies the existence in organized beings, not only of any substantial Principle of action, but even of Irritability or Vitality, as a property essentially distinct from those of which inorganized matters are possessed; "the difference between the two," he says, "being purely formal" (*Philosophy of Life*, 1818, p. 29). To this *ultra* proposition, however, as applied to the actions, any more than as applied to the structure of the two, in which respect also, as we have already seen, some attempts have been made to identify them, it is impossible to assent. Similar general doctrines were in the meantime advocated in France by Magendie, Broussais, Adelon, Dutrochet, Brâchet and others—in particular by Adelon, who, after enumerating the chief actions of organized beings, says expressly, "ces actions —constituent une Vie;" (*Physiologie de l'Homme*, 1823) and whose three admirable chapters on the Philosophy of Physiology might serve to settle, in all but the most blindly prejudiced minds, once and for ever the ques-

Note 11.

Morgan.

Adelon.

Note 11.

Milligan.

tion respecting the existence of Life, "comme un Etre réel." (Tom. iv, p. 645). Dr. Milligan, the translator of Magendie, observes, in allusion to the doctrine of a Vital Principle, "the student will do well, in all such dubious expressions by authors, to substitute for Vital Principle the words Vital State or Vital Action." "The primary idea of Life," he remarks, "in our language, signifies motion—and if we analyze the idea, as it arises in our minds, we shall find that an inherent or independent faculty of motion, accompanied by frequent, actual, appreciable motion, constitutes the whole of our notion of Life, before it is adulterated by the study of the natural sciences, and the writings of philosophers."

Mayo.

(*Translation of Magendie's Comp. of Physiol.*, 1823, note to p. 9, 1, 16). Mr. Mayo again says, almost in the words of Lawrence, "the term Life is a collective expression for an assemblage of phenomena." (*Outlines of Physiology*, 1827, p. 8, and 1833, p. 2). But the author who, in modern times, has most systematically and successfully taken up the cudgels against the substantialists is Dr. Prichard, who, after enumerating, in a masterly manner, the chief phenomena to explain which a substantial Vital Principle has been so unnecessarily put in requisition, and showing the polypragmatical and often

Prichard.

inconsistent nature of the part assigned to it, concludes “that the hypothesis of a Vital Principle has been proved, by a careful examination, to be wanting in every characteristic of a legitimate theory.” (*On the Vital Principle*, 1829, p. 132). Dr. Prichard is somewhat too fond of chemical and mechanical explanations of vital processes, but, in as far as he admits of Vitality at all, seems to be persuaded that it results from organism; and it is only from having fallen into the common inaccuracy of confounding Vitality with Life, that he objects to the definition of Life given by Cuvier, Bichât and the rest, and says “that Life (meaning Vitality) may subsist without the performance of any function” (p. 1). They agree in fact, but differ in words. Since this time various other authors have adopted this view of the nature of Life—among the rest the laborious and talented Tiedemann, by whom the term Life is distinctly restricted to signify the sum of the actions, or, as he calls them, manifestations of activity of organized beings; and who, speaking elsewhere of Irritability or Vitality, aptly remarks, “how wrong the physicians and philosophers have been who created it as a fundamental force of Life, or the Principle of Life (ψυχῆ). They have mistaken for the cause of Life a simple property of or-

Note 11.

Tiedemann.

- Note 11. ganized bodies, which is the consequence of the plastic force" (*i.e.* of their organism) (*Translation of Tiedemann's Physiology, by Gully and Lane, 1834, § 82 and 557*).
- Roget. Lastly Dr. Roget, in his highly classical work published last year,* describes Life as "consisting of a continued series of actions directed to particular purposes" (*Bridgewater Treatise, 1834, p. 58*); Dr. Wilson Philip, one of the most deservedly celebrated of British physiologists, albeit in some points perhaps mistaken, in a work published only a few months ago, aptly remarks, "Life, without much violence done to language, has been called a forced state—it consists of excitement called into action by suitable stimulants" (*Phil. Trans. republished in Essay on Sleep and Death, 1835*); and Dr.
- Wilson Philip.
- Clark. Clark, in his report still more recently published, describes living bodies as possessed of "as many species of excitability, and as many modes of reaction as there are tissues, and represents Life as consisting in this reaction, excited in each by its own appropriate stimuli" (*Report on An. Physiol. read in 1834 published in 1835*). The tendency in the human mind to personify its abstractions must really be insuperable, if it can resist all the weight of reason and authority which may be brought forward

* 1835.

against the indulgence of it in this instance." J. Fletcher.

Note 11.

1837. *Rudiments of Physiology*. 2nd part, p. 35.

Dr. Carpenter thus defines Life "If we regard as a *living* being an organized structure, the *sum of all the actions** performed by such a being from its first production to its final dissolution may be designated its *life*."†

Carpenter.

"The sum of all the phenomena which constitute the Life of an organized structure."‡

Dr. Carpenter considers Life as "synonymous with vital action."§

Also John Marshall,—“Indeed in this active condition of all the parts of the body, manifested through the exercise of the various vito-physical, vito-chemical, and vital properties, called into play by external and internal stimuli, which yields a total result known as *vital* action or *life*. The life of an individual animal is the sum of its various actions, the aggregation of its vital phenomena.—‘Life is organization in action’ (Béclard).”—*Physiology*, 1 vol., p. 105, 1867.

John Marshall.

* Italics in original.

† *Physiology*, 1st edit. of 1839, p. 132.

‡ *Ibid*, p. 3.

§ *Ibid.*, p. 140.

Note 11.
Latham.

Lewes.

H. Spencer.

Latham in his Dictionary quotes Herbert Spencer for a definition of "life" as "the co-ordination of actions," and he in turn quotes that of Mr. G. H. Lewes as follows:—"Life is a series of definite and successive changes, both of structure and composition, which takes place within an individual, without destroying its identity," but Mr. Herbert Spencer objects to this as insufficient from its not including the mere visible movements with which our idea of life is most associated. Mr. Herbert Spencer implies, without quite asserting it, that the life of an organized being includes all its actions, motions, and functions, or as Bichât expresses it the "sum of the functions." "Inductions of Biology."

A very cursory examination of standard authors will show that Dr. Milligan's assertion is strictly correct.—"That the primary idea of 'life' in our language signifies motion; and that an independent power (capacity) of moving accompanying appreciable motion constitutes the whole of our notion of 'life.'"

Locke.

Thus, Locke remarks:—

"The identity of the same man consists in nothing but a participation of the same continued 'life' by constantly fleeting particles of matter, in succession vitally united to the same organized body"—

“ Did on the stage my fops appear confin’d ?
My life gave ampler lessons to mankind.”—*Masks and Faces*.

Note 11.

“ All that cheers and softens life
The tender sister, daughter, friend or wife.”—POPE.

“ His faith perhaps in some nice tenets might
Be wrong, his ‘ life ’ I’m sure was in the right.”—COWLEY.

“ Such was the ‘ life ’ the frugal Sabines led,
So Remus and his brother god were bred.”—DRYDEN.

“ He can’t be wrong whose ‘ life ’ is in the right.”—POPE.

“ Sir Wm. Grove says, that in the human body we have chemical action, electricity, magnetism, heat, light, motion, and possibly other forces, ‘ contributing in the most complex manner to sustain that result of combined *action* which we call life.’ ”* Grove.

In this quotation life is correctly employed to signify living action. That Sir Wm. Grove ever asserted that chemical action and motion are forces, it is impossible to decide as no reference is given by Dr. Beale.

Dr. Lionel Beale calls attention to the absurdity of an action of any kind resulting from force without any object on which such force can act. Beale.

* Sir Wm. Grove quoted by Dr. Lionel Beale on *Protoplasm or Matter and Life*, p. 47 of 3rd edit., 1874.

Note 11.
Jaccoud.

Dr. Jaccoud of Paris—uses the word “life” in this sense.

“An organized substance [contagium] might like a simple chemical agent cause an injurious *excitement* by setting in play all the activities of the organism to produce an abnormal mode of ‘life.’—Neither of these opinions would be repugnant to the idea of life.”*

“Let no remarkable event
Pass with a gaping wonderment,
A fool’s device; ‘Why who would think’
Commit it safe to pen and ink,
What’ere deserves attention now—
For when ’tis past, you know not how,
Too late you’ll find out to your cost,
So much of human ‘Life’ is lost.”—
JOHN BYROM, F.R.S., of Manchester.

* Quoted by The Doctor, Aug., 1877, p. 160.

NOTE XII.

ORGANIZED BEINGS AND MATTER.

(*Difference of from Fletcher's Rudiments of Physiology, 1837.*)

THE term Physiology signifies etymologically the History of Nature; and it was in this comprehensive sense that it was employed by the ancients in general. By the earlier moderns it was restricted to signify the History of that branch of medicine which relates to the nature and functions of Man; but it has more recently been again extended to include the nature and functions, not only of other Animals, but of Plants also. In this acceptation of the term, Physiology may be defined to be the Science of those actions of Organized beings in which Life consists;* in other words, the Science of Life.† It has been proposed by some late authors to

Note 12.
Fletcher.

* John Fletcher.

† By Rudolphi and others, Physiology has been defined to be the Science of Organism. An organized being without life is, according to Rudolphi, a thing which cannot be conceived, since organism and life always begin and terminate at the same instant, and exist together in the same degree: the term life then signifies, he says, the same thing as organism. (*Grund. der Physiol.* 1821,

Rudolphi.

Note 12.
New Terms.

supersede the term Physiology, by the terms, Organonomy, Phytonomy, Zoonomy, Bionomy, Biology or

Adelon.

1, § 2, and § 209). And indeed, if he employ the term organism to signify something, not merely co-existent, but identical with life, the proposition is a mere truism, and the alteration in the definition was only superfluous; but if he employ it, as appears to be the case, to signify organic structure, the proposition is mistaken, and the alteration was vicious. It is not the case, as assumed by Rudolphi and so many others, and among the rest by Adelon, that “le mode de structure, appelé organization, (organisme) et le mode d’activité, appelé vie, existent toujours ensemble;” (*Physiol. de l’Homme*, 1823, 1. 31) the error having originated in confounding life with vitality or irritability, a constant attendant indeed on organism, and a necessary condition of life, but still not life itself—not “la vie,” but “l’aptitude à vivre.” Indeed Rudolphi himself appears elsewhere to be aware of the distinction; and describes, not life, but vitality only as co-existent with organism, admitting that there can be no excitement—that is to say no life—without the requisite stimuli to excite, as well as the requisite susceptibility of being excited; (§ 214). An asphyxized man is not disorganized but he manifests no life; and the Eel of blighted corn—*Vibrio* 1—may continue organized, and retain its vitality for twenty or thirty years; nay the seeds and bulbs of some plants may do so perhaps for a hundred times that period, but without in all that time exercising any one of the

some other more precisely indicative of the scope and bearings of the science; but this endless introduction, on every frivolous pretence, of new technical terms is adapted, much less to benefit, than to injure the cause of philosophy.

Note 12.

Organized beings then, are distinguished from Inorganized matters by certain peculiarities, *in the first* place in their Structure, and *secondly* in their Actions. With respect to their Structure the following may be said to be the principal distinctive marks respectively :

OF INORGANIZED MATTERS.	OF ORGANIZED BEINGS.
1. A body of an indefinite form, or of one presenting flat surfaces, and bounded by straight lines; of an indeterminate bulk, and without any general envelope.	1. A body of a definite form, (<i>Individual</i>) presenting convex or concave surfaces, and bounded by curved lines; of a determinate bulk; and invested by a general envelope.

functions in the sum of which life consists. Vitality or irritability, resulting as it does from organism, can never fail otherwise than from the destruction of this organism, and the return of the organized being to the state of inorganized matter; but life may fail without any such conditions. It is Anatomy which, as observed long ago by Richerand, is the Science of Organism, while Physiology is the Science of Life.

Vitality.

Richerand.

Note 12.

2. An aggregation of homogeneous parts, no one of which bears any certain relation to the rest.

3. A substance exclusively either solid, liquid or aëriform; the particles of which are merely either superimposed upon, or intermingled with, each other.

4. A composition each of but few elements, associated into binary compounds; which, as formed by common chemical attraction, are easily imitated artificially, and which are not prone to spontaneous decomposition.

2. An aggregation of heterogeneous parts, (*Organs*) each of which bears a certain relation to the rest.

3. A substance conjointly solid, liquid and aëriform; (*Tissues and Fluids*) the solid particles being as it were, interlaced or interwoven together, and traversed by the fluid.

4. A composition each of several elements, associated, at least after the cessation of their vitality, into ternary or quaternary compounds; (*Proximate Principles*) which, as formed by secretion, are not capable of being imitated by art, and which are prone to spontaneous decomposition.

The characteristic differences between the two great kingdoms of nature are of course the more pronounced, the higher is the rank of any individual organized being, between which and inorganized matter the comparison is made; but even between the lowest tribes of the

former and mere *bruta tellus*, the distinctions, as well in structure as in actions, are still too broad, to allow of our assenting to the speculations of those who represent the two as fundamentally the same.*

Note 12.

The contents of the preceding Note appertain only to the differences in their Structure between Inorganized matters and Organized beings, involving the consideration of their form, aggregation, substance and composition: the next subject to be treated of is the differences in their Actions. The following then are the chief characteristic Actions respectively:

OF INORGANIZED MATTERS.

Those only by which their particles are held together, and by which they retain the same composition, substance, aggregation and form, unalterably for ever, unless these are changed by some external agent.

OF ORGANIZED BEINGS.

1. Those by which they continually secrete and give off from their fluids, into the medium by which they are surrounded, certain gaseous substances, while they absorb from it others, for the purpose of effecting some necessary changes in the composition of these fluids. (*Respiration*).

* From *Rudiments of Physiology*, by John Fletcher, 1837.—Part 1, *On Organism*.

Note 12.

2. Those by which they continually propel these fluids through the solid parts of their structure, for the purposes, on the one hand of forming and depositing new solids and fluids, and on the other of breaking down and carrying away old ones, such of the latter as are useless being thrown entirely out of the system. (*Circulation, Deposition and Absorption*).

3. Those by which they at intervals receive from without certain solid and liquid substances which they assimilate to the nature of the fluids so employed, for the purpose of renewing them in proportion as they become wasted. (*Assimilation*).

4. Those by which they at intervals form and throw off certain organized parts, for the purpose of continuing their species. (*Generation*).

[The duration of these mat-

[All these actions are, under

ters, therefore, may be said to depend on their being allowed to remain unchanged—in other words, on their apparent repose. (a)]

ordinary circumstances, (b) essential, first to the continued existence of organized beings as individuals, and secondly to their perpetuation as species; consequently the duration of these beings may be said in general to depend on their being continually decomposed and re-composed—in other words, on the obvious actions which are constantly going on within them. (c)].

Note 12.

(a) The repose is here merely *apparent*, and the term is used therefore as opposed only to *obvious* action, since it is by a constant insensible action—namely by attraction and repulsion, in one or other of their modifications—that repose itself is maintained. Even the *vis inertiae*, in every thing but the ultimate atom of matter, depends upon their exercise.

(b) The expression “under ordinary circumstances” is added for the purpose of meeting those extraordinary cases, some of which have been already alluded to, in which organism survives for a longer or shorter period the display of any obvious action whatever.

(c) Organized beings are accordingly compared by Cuvier—and well compared, notwithstanding the protest of Dr. Barclay—“à des espèces de foyers, dans lesquels les substances mortes sont portées successivement pour s’y combiner entre elles de diverses manières, et pour s’en échapper un jour, afin de rentrer sous les lois de la matière

Note 12.

In addition to these actions of organized beings in general, are some others, commonly presumed to be proper to animals, and certainly requiring other conditions besides those which alone are necessary to the foregoing ; such as—

5. Those by which they become conscious of impressions made upon them. (*Sensation*)

6. Those by which, in virtue of this consciousness, they reason and will. (*Thought*)

7. Those by which, in virtue of this will, they effect various movements. (*Voluntary motion*)

Animal heat.

It is usual to enumerate, among the characteristic actions of organized beings, those by which they evolve heat; and if this be done, we should specify also others by which many such beings evolve likewise light and electricity. But none of these phenomena are in fact

morte ;" (*Leçons d'Anat. Comp.* 1799, *Tom.* i. p. 5) and again, "La vie," says he, "est un mouvement de tourbillon, plus ou moins rapide, plus ou moins compliqué." (p. 6).

proper vital actions, but the necessary physical results of some of those actions which have been above mentioned; and indeed the evolution of cold—if the expression may be allowed—is often not less remarkable, as the result of such actions, than that of heat, the balance on either side depending, in any given instance, on the comparative energy of those vital actions from which heat and cold respectively result. If it be admitted that the carbonic acid which appears in respiration is not produced by the immediate combination of the carbon of the venous blood either with the oxygen of the air in the lungs, as we are taught by Mayow, Priestley, Black, Lavoisier, Crawford, Ellis and others, or with the oxygen of the arterial blood in the parenchyma of the body, as supposed by Lagrange, Hassenfratz, W. F. Edwards, C. Williams and the rest, but secreted from the venous blood in its passage through the lungs, while the oxygen which disappears is absorbed into the nascent arterial blood in the same passage, as has been already assumed, and as may be proved to be the case by all but conclusive evidence; if it be conceded, as it universally is, that, while there is very little difference in the density of venous and arterial blood, the density of carbonic acid considerably exceeds that of oxygen; and lastly, if

Note 12.
Animal heat.

Note 12.
Animal heat.

it be admitted that there is little or no difference in the bulk of the secreted and absorbed gases, as has been abundantly established; the extrication of animal heat involves no new vital action, but is a necessary physical result of others, and the theory of this process—so long regarded as one of the most inexplicable problems—becomes one of the most simple and satisfactory in all physiology. The conversion of a liquid into a gas *must* by rarification produce cold, whilst the opposite conversion of a gas into a liquid *must* by condensation produce heat; and—the density of the two liquids being nearly the same—had the density of the two gases been so too, keeping in mind that their bulk is equal, the one process would have neutralized the other, and neither sensible cold nor sensible heat would have resulted. But the density of the two gases is not equal: the transition therefore of the liquid into the denser gas produces less cold than that of the rarer gas into the liquid produces heat, and what is called animal heat is thus merely the result of the absorption of oxygen into arterial blood, *minus* that of the secretion from venous blood of carbonic acid. And when we reflect that in the human being the temperature of not less perhaps than ten pounds of arterial blood is sensibly raised by this means

about 2° every minute, as first insisted on by Dr. Holland of Sheffield, (*Experimental Inquiry, &c.*, 1829)* and that he has not continually to extricate *de novo* a quantity of caloric sufficient to constitute the whole difference between the temperature of his body and that of the atmosphere, but merely to keep up what is in any given time passing from him, we shall not require any aid from the latent heat doctrine, nor from any other, easily and satisfactorily to explain the whole process. Perhaps indeed the theory above proposed may be, as

Note 12.
Animal heat.
Holland.

* John Fletcher always gave Dr. Holland the credit of framing this hypothesis of the cause of animal heat, as he was the first to give it publicity in print. Yet it is well known to Fletcher's old pupils, that this was one of his numerous doctrines, which, received by his disciples as established truths were innocently published by them without alluding to their real author.

“ In asthma and in cyanosis, in which, owing to a communication between the right and left auricles of the heart, the blood is imperfectly oxygenated in the lungs, the temperature of the body is unnaturally low; this is also the case in syncope, apparent death and cholera. In the collapse of this disease the temperature of the surface may be 15° to 28° below the ordinary standard.”†

Marshall.

† John Marshall's *Physiology* of 1867, p. 506 of vol. ii.; and see Note, end of Chap. I.

Note 12.
Animal heat.

Magendie says, “trouvée trop simple;” but in the mean time, were the present the place for entering in detail into the subject, it would be easy to show that, simple as it is, while it is supported by every fact which was at one time supposed so strongly to corroborate that of Black and Crawford, it is amenable to none of the objections which must be fatal to the latter, and at the same time explains many circumstances which neither this nor any other theory has approached. At all events Calorification is no more a vital action *per se* than Frigorification, which has long by general consent been allowed to be the natural and necessary result of transpiration, the inconsistency in the mean time of attributing heat to one gaseous exhalation, and cold to another having been overlooked. The secretion of carbonic acid is, and must be directly a source of cold, but, the absorption of oxygen always corresponding with it, it becomes thus indirectly a source of heat; whereas the secretion of halitus—so much rarer as it is, to begin with, than carbonic acid—is a source of unqualified cold, there being in this instance no counteracting power in operation.—J. Fletcher.*

* *Rudiments of Physiology*, by John Fletcher, part 2, p. 4, published in 1837.

NOTE XIII.

FIGURATIVE LANGUAGE.

SOME medical men pride themselves on their practical common sense, and yet employ language so figurative as to imply theories the most abstruse and incomprehensible.

Note 13.
Figurative
Language.

Certain authors assume that any part of an organised being may set up for itself, and carry on such actions or changes as suits its own ideas of duty, comfort, or prerogative, without the slightest regard to the welfare of the rest of the system.

Thus, Moxon remarks:—"That the intercellular elements *take on* the formation process, the elements if they are rapidly produced are of *evil disposition*."* He requests the students to "Now please observe an important opposition in the *behaviour* of the two sets of elements." Again, "Whenever the tissues of the corium *take on action* then the disease is obstinate and severe." Mr. Maunder "called to mind instances of a lacerated wound of the cheek *taking on* tertiary ulceration." Another

Moxon.

Maunder.

* *Medical Times*. Oct. 22, 1870.

Note 13.

author declares that, "uric acid itself and urate of soda are plainly to be expected when the living system is *bent on constructing* uric acid, and at the same time, is not capable of constructing urate of ammonia." Again, dropsy is produced as follows:—"The lungs *degenerate*" (like modern Greeks) "and *become emphysematous*." Also,

A. Flora.

Dr. Anton Flora describes a "rodent ulcer *rebellious* (like the French communists) "under the treatment adopted to arrest it."

Some old philosophers have imagined that the world was a great animal pursuing his course through the universe at his free will and pleasure, and all known animated beings were merely parasites infesting his dense tegumentary envelope.

Virchow.

Something of a similar hypothesis is entertained by Virchow* as regards each animal, he treats it as though it consisted of a world of separate living beings, each with sensation, thought, and voluntary motion, and having its own opinions as to its special duties. "He is enabled by aid of the microscope to draw boundaries to each cell territory, and advance direct evidence that certain districts of intercellular substance is *ruled over* by

* Page 15 of translation.

the cell which lies in the middle of it, and *exercises influence* upon the neighbouring part," just as formerly the Emperor of Austria ruled over his hereditary dominions, and exercised influence over the Italian Duchies.

Note 13.

Mr. Jonathan Hutchinson remarks:—"I have listened with extreme pleasure to the very able paper which Mr. De Morgan has read to us, and my pleasure has perhaps been increased because his views are very much like those which I entertain myself. Now take the case of the transmission, of what I would ask permission, to call the cancerous tendency or proclivity, which I suppose, consists of some kind of morbid mobility of slow growth—a tendency to go into insurrection amongst the cells, an unwillingness to submit to continuous government, exhibiting something of the difference which exists among the different races of mankind. Amongst the stupid Teutonic race, there is a willingness to submit, even to a certain amount of oppression, rather than rebel; while amongst the more vivacious and the more freedom loving Celts, there is a proneness to rebel, an unwillingness to submit continuously for a long period to any systematic government.—So I think we have, in different individuals, some sort of different mobility of tissue. In one person, the tissues are held together by

Jonathan
Hutchinson.

Note 13.

a somewhat slighter tie than they are in others, and under certain kinds of irritation they rebel, and the cells set up on their own account, and establish a little *imperium in imperio*, and to that rebellion of the cells we give the name of cancer.*

Heitzman.

Heitzman, however, entertains a better opinion of the cells, as more amenable to constitutional government—he asserts that “the cells form a perfect democracy. When examining the articular cartilages from living animals, he found finely contoured cells, provided with nuclei, from which processes were given out in all direction into the matrix.”

“The matrix was traversed in all directions with delicate tubules, continuous with those from the cell bodies.”

“These cells therefore, do not possess or govern (Virchow's views) a definite cell territory, but they rather form collectively a cell colony, all the component parts of which act and react as a whole upon external agents and conditions.”†

Prof. Huxley does not entertain this favourable opinion of the cells as expressed by Heitzman—he

* *Brit. Med. Journal*, March 7, 1874.

† *Brit. Med.-Chir. Rev.*, April, 1873, p. 513.

rather agrees with Dr. Moxon of Guy's, that they are Note 13.
“when rapidly produced of evil disposition,” he remarks:—“Under the influence of certain external conditions elements of the body, which should have developed in due sub-ordination to its general plan, set up for themselves, and apply the nourishment which they receive to their own purposes.”*

Prof. Huxley considers that “the innumerable minute cells of which the higher animals are composed, are each of them itself an equivalent of one of the lowest and simplest of independent living beings—the *Torula*.”† Huxley.

Thus, man is a bag of animals and yet his basis is merely physical.

Near the conclusion of his work Virchow speaks thus Virchow.
respectfully of pus, for which surgeons in general never have a good word. He says,‡ “It” (pus) “is not produced by any special act” (such as secretion) “by any creation *de novo*, but its development proceeds from *generation to generation*” (like a Scotch family of distinction) “in a perfectly regular and *legitimate* manner.”

* *Critiques and Addresses*, p. 240 of edit., 1873.

† *Ibid.*, p. 86 of edit., 1873.

‡ Page 421, translation.

Note 13.
Ross.

Dr. James Ross of Waterfoot, near Manchester, does not allow that pus has any claim to such an aristocratic pedigree, but rather refers it to a communistic origin.

Thus, the *Practitioner* remarks:—"Pus, as Ross rightly observes, is the very type of disorderly, over-rapid and unstable formation, it *represents* mere dynamic explosion, with scarcely a tendency to *tension* equilibrium."

Fox.

Dr. Tilbury Fox considers that ringworm arises "from a want of *nerve tone*," and on the other hand Dr.

Anstie.

Anstie "has proved from a number of observations that chloral excites a steady *toning* influence on the arterial web."

Milner
Fothergill.

Dr. J. Milner Fothergill asserts that "veratrum viride has long enjoyed a reputation, chiefly in America, as a neurotic of the circulation."*

Clifford
Allbutt.

Dr. Clifford Allbutt says, "The known effects of pyrexia fall into two chief categories—oppression of the nerve centres—and in greater combustion of tissues."

Hence Chapman advocates cold water to put out the fire.

The editor of the *British Medical Journal*, when com-

* *Brit. Med. Journ.*, Jan. 17, 1874.

menting on Capt. Webb's exploit of swimming across the Channel, compares him to a steam locomotive—"his body heat was conserved and his stores of force thus rendered available for muscular effort. Combustion within the body produces heat and mechanical effort, and when the powers are taxed to produce heat, or the temperature falls, muscular [mechanical?] effort fails partially or absolutely."*

Note 13.

In a Clinical Lecture by J. D. Heaton, M.D., F.R.C.P., and published in the *Brit. Med. Journ.*, May 30, 1874, occurs the following:—

Heaton.

"The process by which the heat of the body is maintained, is allied to the development of heat in a hot bed, or in a damp hay stack [putrefactive fermentation?] or that by which accumulations of waste in a cloth-mill occasionally become ignited."

* Aug., 28th, 1875.

NOTE XIV.

On Causes and Remedies of Disease which are not material and therefore cannot produce their effects by being absorbed by the vessels of the body.

1. LIGHT A CAUSE OF DISEASE.

Of Tetanus.

DR. RENZI of Venice.

Gazette Medica Italia Prov. Venete.

Quoted by *Brit. Med. Journal*, May 29, 1875.

Of Headache.

DR. WM. HEBERDEN.

Commentaries, p. 97 of Edit. of 1803.

2. LIGHT A REMEDY OF DISEASE.

Of Melancholia ... as red light. } DR. PONZA of Alexandria, DR. BONGIO-
Of Mania ... as blue light. } VANNI of Pavia and DR. MANFREDI.

Gazette des Hôpitaux of Feb. 12, 1876.

Quoted by *The Doctor*, Oct. 1876, p. 184.

Of Variola ... as yellow light. Mr. R. C. CROFT.

Morning Post, Aug. 2, 1877.

3. DARKNESS A CAUSE OF DISEASE.

Of Imperfect Respiration. MOLESCOTT AND VAN PLATEN.

Pfluger's Archiv: xi. p. 272.

Quoted by *Practitioner*. March 1876, and p. 237.

4. FATIGUE A CAUSE OF DISEASE.

Of Fever.

HIPPOCRATES.

Epidemics, Book 3, Case viii.

„ „

DR. JAMES.

Dictionary, Edit. of 1745, (Art. Pyretos).

„ „

DR. THOMAS WILLIS of Oxford.

Works. Sec. 1 p. 91, of Edit. of 1681.

Of Meningitis Spinal.

DR. JOHN MACKINTOSH of Edinburgh.

Pract. Phys. Vol. 2, p. 64 of Edit. of 1832.

Of Arteritis.

DR. A. TWEEDIE.

The Library of Medicine, Vol. 4, p. 7.

Of Sciatica.

DR. JAMES BUZZARD.

Hospital for Paralysed and Epileptic.

Practitioner, Feb. 1877, p. 98.

Of Chronic Gastritis.

DR. A. TWEEDIE.

Library of Medicine, Vol. 4, p. 61.

Of Gout.

DR. THOMAS WILLIS, of Ch. Ch. Oxford.

Works, p. 218 of Edit. of 1681.

Of Cephalalgia.

DR. W. HEBERDEN.

Commentaries, p. 97 of Edit. of 1803.

Note 14.

5. REST WITH DARKNESS—A REMEDY OF DISEASE.

Of Orchitis.

DR. G. BRAMBILLA.

Gaz. Lomb, No. 38, 1872.Quoted by *Brit. and For. Med. Chir. Rev.*, Jan. 1873,
p. 189.

Of Tetanus.

DR. HENRI DE RENZI of Venice.

*Gaz. Med. Italia Venet.*Quoted by *Brit. Med. Jour.*, May 29, 1875.

" "

MR. G. FLEMING.

Surg. Maj. Royal Engineers, Chatham.

Practitioner, March 1877, p. 193.

Of Convulsions.

Rest in sinistro-lateral position.

DR. FRED. JAMES BROWN.

Practitioner, April 1876, p. 292.

Of Chorea.

DR. RANSON DEXTER, of Chicago.

London Medical Record, July 15.Quoted by *Edin. Med. Jour.* May 29, 1875.

Of Hydrophobia.

SURG. MAJ. FLEMING.

Practitioner, March, 1877, p. 193.

6. HEAT A CAUSE OF DISEASE.

Of Fever.

E. LONG FOX, M.D.

Medical Times, Feb. 5, 1870.

„ „

DR. JAMES.

Dictionary, Edit. of 1845, (Art. Pyretos).

Of Intense Fever.

SIR JOSEPH FAYRER, M.D., &c.

Practitioner, March 1876, p. 179.

„ „

VAN SWIETEN.

Commentaries by Schomberg, Vol. 4, p. 332.

Of Epidemic Fever.

RICHARD MEAD, M.D., &c.

Works, Vol. 2, p. 473 of Edit. of 1762.

Of Diarrhoea.

DR. W. L. EDGAR.

St. Louis Med. and Surg. Jour., Sept., 1871.

„ „

DR. FARR.

Quoted by SIR T. WATSON, Vol. 2, p. 517, 4th Edit.

Of Diseases of Liver.

DR. A. TWEEDIE.

Library of Medicine, Vol. 4, p. 159.

Of Nervous Apoplexy.

DR. L. P. YANDELL.

In Report of Louisville Coll. of Phys. and Surg.„ „ „
or Sunstroke.

{ SIR JOSEPH FAYRER, M.D., &c.

Practitioner, March, 1876, p. 179.

„ „ „

SURG. MAJ. T. C. O'LEARY, M.B.

Practitioner, March, 1876, p. 196.

Of Pulmonary „

DR. RICH. TOWNSEND, of Dublin.

Cyc. Pract. Med., Vol. 1, p. 138.

Note 14.

6. HEAT A CAUSE OF DISEASE. (*Continued*).

- Of Lichen Simplex. PROF. ERASMUS WILSON, F.R.S.
Portraits of Diseases of the Skin.
- Of Eczema Solare. DR. W. BRUCE JOY, of Dublin.
Cyc. Pract. Med., Vol. 1, p. 678.
- Of Hemiplegia. FRED. BATEMAN, M.D.
Practitioner, April, 1869, p. 110.
- Of Aphasia. ABERCROMBIE.
Quoted by FRED. BATEMAN, M.D.
Practitioner, April, 1869.
- Of Paralysis in a child. DR. JAMES ANDREW, DR. DYCE DUCKWORTH. and DR. C. WEST.
Brit. Med. Journ., May 5, 1877, p. 548.
- Of Insanity. A LATE INMATE OF GARTNAVEL ASYLUM.
Philosophy of Insanity, p. 19. Maclachlan and Stewart, 1860.
- Of Parenchymatous Degeneration. DR. WICKHAM LEGG.
Path. Soc., May 6, 1873.
Quoted in *Brit. Med. Journal*, May 31, 1873.
- Of Syncope. SIR JOSEPH FAYRER, M.D.
As mentioned above.
- Of Tetanus. DR. J. B. CARRUTHERS.
Edin. Med. Journ., March 1877, p. 800.
- Of Mania. DELACOUX and OBERNEIER.
Quoted by DR. CHAS. S. W. COBBOLD.
London Medical Record, Jan. 15, 1878, p. 9.

6. HEAT A CAUSE OF DISEASE. (*Continued*).

Of Melancholia.

BARCLAY.

Quoted by DR. CHAS. S. W. COBBOLD, as above.

Of Insomnia.

(As applied to the feet).

DR. JOHN CHEYNE.

Cyc. Pract. Med., Vol. 4, p. 458.

Note 14.

7. HEAT A REMEDY OF DISEASE.

Of Bronchitis

DR. R. WEISER.

Wien. Med. Wochenschrift. No. 35, 1871.

Of Pneumonia

by actual cautery.

DR. BROWN-SEQUARD.

The Doctor, Nov. 1875, p. 208.

Of Carditis

DR. R. WEISER (as above).

Of Arachnitis

" "

Of Encephalitis

" "

Of Rheumatism.

THOS. S. DOWSE, M.D. and F.R.C.P. Ed., of Highgate,
London.*Brit. Med. Jour.*, 9th Jan. 1875, p. 39.

Of Scarlatina.

DR. R. WEISER (as above).

Of Croup.

" "

Of Diarrhœa.

" "

Of Hydrothorax

DR. BROWN-SEQUARD (as above).

Of Hydrops Pericardii

" "

Of Hydrarthrus.

" "

Of Hæmaturia

DR. J. W. BEGBIE, of Edin.

Edin. Med. Jour., May, 1875, p. 1015.Of Hæmorrhagia
Uteri.

DR. WINDELBAND, of Berlin.

Allgemeine Medicinische Central-Zeitung, Jan. 27, 1875.Quoted by *Brit. Med. Jour.*, Feb. 13, 1875, p. 212.

M. RICORD.

Union Medicale, June 5, 1877.

DR. LOMBE ATTHILL of Dublin.

Dublin Med. Jour., Jan. 7, 1878.

7. HEAT A REMEDY OF DISEASE. (*Continued*).

- Of Acute Mania. DR. ABLETT of Whitehaven.
Brit. Med. Jour., Nov., 26, 1876, p. 686.
- Of Metrorrhagia. DR. N. GUENEAU DE MUSSY.
DR. CHAPMAN.
Med. Gaz., Dec. 11, 1875.
- Of Chorea as actual cautery.
DR. BROWN-SEQUARD (as above).
- Of Paralysis Agitans. „ „
- Of Epilepsy. „ „
- Of Sciatica. DR. ALLAN JAMIESON.
Edin. Med. Jour., March, 1877, p. 794.
- Of Tetanus. MR. WAGSTAFFE of St. Thomas's.
Brit. Med. Jour., Oct. 20, 1877, p. 563.
- „ DR. ZECHMEISTER, and
DR. GOTTLIEB KRAUS.
Allg. Wiener. Med. Zeitung.
Quoted by *The Doctor*, April, 1878.
- Of Acne Rosacea. DR. PIFFARD.
Charleston Med. Jour. and Rev., Jan. 7, 1877.
- Of Varix. Ditto.
Quoted in *Brit. Med. Jour.*, Oct. 20, 1877, p. 567.
- Of Spasmodic contraction of muscles. DR. JOHN GIBNEY of Brighton.
Observations on cold and warm sea bathing, p. 61.
- Of Gangrene as warm bath.
DR. F. G. HAMILTON of New York.
Lond. Med. Record, April, 1878, p. 173.

Note 14.

8. ELECTRICITY A CAUSE OF DISEASE.

Of Laryngitis.

SAMUEL.

"The Trophic Nerves."

Quoted by *Practitioner*, Feb., 1873.

Of Pneumonia.

Ibid.

Of Eczema.

From Pulvermacher's chain.

Practitioner.

Of Gravel.

RISTELHUNTER.

*Journal de Bas Rhin.*Quoted in FLETCHER'S *Pathology*.

Edited by DRYSDALE and RUSSELL. Vol. i., p. 58.

MACLACHLAN and STEWART, 1842.

Of Palsy.

Ibid.

Of Dyspnœa.

Applied to superior laryngeal nerve.

ROSENTHAL.

Practitioner, April, 1874, p. 248.

Of Nervous Apoplexy. DR. WALTER R. S. JEFFERIES of Lochnaber.

Brit. Med. Jour., Jan. 22, 1876.

Of Epilepsy.

DR. FERRIER.

"West Riding Lunatic Asylum Reports." Vol. iii.,
1873.Quoted by *Brit. Med. Jour.*, Dec. 27, 1873, p. 767.

Of Hæmatemesis.

SAUVAGES.

Nosol Method.

" "

FRANK.

De Curand. Homin. Morbis, lib. v., part 2, p. 204.

Quoted by DR. GEORGE GOLDIE of Shrewsbury.

Cyc. Pract. Med., Vol. 2, p. 395.

9. ELECTRICITY A REMEDY OF DISEASE.

- Of Typhoid Fever. GLAX.
Pestir. Med. Clin. Presse.
 Quoted by *Brit. Med. Jour.*, April, 11, 1874, p. 480.
- Of Ophthalmic Choröitis. DR. POGGIOLI.
Tribune Medicale.
 Quoted by *The Doctor*, Dec., 1875.
- Of Conjunctivitis granular. DR. TRENHART.
New York Med. Record, Dec. 16, 1872.
 Quoted by *Practitioner*, June, 1873, p. 397.
- „ „ DR. RIDOFFI.
 Quoted by *The Doctor*, Dec., 1872.
- „ „ SCHIVARDI.
Central Zeitung, June 31, 1872.
 Quoted by *The Doctor*, June, 1873.
- Of Arthritis. DR. WEISFOG.
The Doctor, Dec., 1872.
- Of Acute Rheumatism. DROSDOFF.
Bokkens Klinik zu St. Petersburg und Rundschau,
 Oct. and Nov., 1875.
 Quoted by *Practitioner*, Jan., 1876, p. 78.
- Of Chronic Rheumatism. *Ibid.*
- „ „ DR. PRINCE.
Report on Medical Electricity, No. 4.
The Doctor, 1873.
- „ „ M. CHERRON of Venice.
Gornale Veneto di Scienze Mediche, Dec. 1869.

Note 14.

9. ELECTRICITY A REMEDY OF DISEASE. (*Continued*).

- Of Rheumatic Gout. DR. ALTHAUS.
- Of Endometritis. DR. THOMAS E. CLARKE of Bristol.
Brit. Med. Jour., Feb. 27, 1875.
- Of Metrorrhagia. DR. A. JACOBI of Mount Sinai Hospital.
Quoted by *The Doctor*, March, 1876.
- Of Neuritis. DR. POORE.
Clin. Soc., London.
Brit. Med. Jour., Feb. 20, 1875.
- Of Ulcers. M. STAES-BRAME.
Bulletin Medicale du Nord.
Quoted by *Brit. Med. Jour.*, Jan. 5, 1878, p. 20.
- Of Erythema. DR. A. OTTO.
Practitioner, March, 1874, p. 214.
- Of Erysipelas. DR. SYCIANKO, OF CHARKOW, RUSSIA.
Berlin Klin. Wochensch, 1870.
- Of Prurigo. DR. H. S. GALE.
Brit. and For. Med. Chir. Rev., Jan. 1874, p. 15.
- Of Eczema. *Ibid.*
- Of Acne. *Ibid.*
- Of Acne Rosacea. W. B. CHEADLE, M.D., F.R.C.P.
Practitioner, July, 1874.
- Of Herpes Zoster. M. PICOT.
Gazette des Hôpitaux, 96—1870.
- „ „ DR. FANQUE, of Philadelphia.
The Doctor, Nov. 1875

9. ELECTRICITY A REMEDY OF DISEASE. (*Continued*).

- Of Lupus. DR. PECK, of Chicago.
4th Report on Medical Electricity.
The Doctor, 1873.
- Of Alopecia. DR. WALDENSTROM.
Philadelphia Med. Times.
Quoted by *The Doctor*, Nov. 1875.
- Of Chillblains. DR. CANCATO,
The Doctor, Dec. 1872.
- Of Frost-bite. DR. SANTOPADRE.
L'Indipendente de Torino, No. 36.
Quoted by *The Doctor*, March, 1874.
- „ „ DR. ALONZO S. LEACH.
Brit. Med. Jour., March 28th, 1874, p. 415.
- Of Nævus. DR. JOHN DUNCAN, of Edinburgh, and
DR. J. C. HUME.
Brit. Med. Jour., Aug. 28th, 1875.
- „ DR. JULIUS ALTHAUS.
Brit. Med. Jour., Nov. 13th, 1835, p. 606.
- Of Grave's Disease. DUSCH, and EULENBERG, and GUTTMAN.
Die Pathologie des Sympatheticus, 1873.
- „ „ DR. MORITZ MEYER.
Quoted by *Edin. Med. Jour.*, June, 1874, p. 1132.
- „ „ CHVOSTEK, and DR. MEYER.
Berlin Klin. Wochen. 1873.
Quoted by *The Doctor*, Jan., 1874.

Note 14.

9. ELECTRICITY A REMEDY OF DISEASE. (*Continued*).

- Of Addison's Disease. M. LACHILONNE.
Reports a case under care of
PROF. SEMNOLA, of Naples,
In *Gazette Medicale*.
Quoted by *The Doctor*, July, 1876, p. 125.
- Of Jaundice. *American Medical Weekly*.
Quoted by *The Doctor*, Sept., 1875.
- „ DR. GERHART.
Berlin Klin. Woch. 1873.
Quoted by *The Doctor*, Jan., 1874.
- Of Suppression of Salivary secretion. DR. DONALD BAYNES.
Canada, Med. Surg. Jour.
Quoted by *The Doctor*, Aug., 1877, p. 151.
- Of Ileus. DR. MACARIO,
The Doctor, Dec., 1872.
- Of Dysmenorrhœa. DR. W. B. NEFFEL of New York.
BROWN-SEQUARD'S *Archives*, No. 4, 1873, p. 367.
- Of Bronchocele. MORITZ MEYER, and
JULIUS ALTHAUS, M.D.
Brit. Med. Jour., Aug. 28th, 1875.
- Of Neuroma after Amputation. DR. MANCA.
The Doctor, 1872.
- Of Tumour of Tonsils, similar to Scirrhus. MR. MAUNDER, and MR. J. ADAMS.
Medical Times, Jan. 25th, 1873.
- „ „ DR. ROCKWELL, of New York.
The Doctor, Sep., 1874.

9. ELECTRICITY A REMEDY OF DISEASE. (*Continued*).

- Of Epithelioma. M. AMUSSAT.
The Doctor, Jan., 1875, p. 16.
- Of Lipoma. }
 Of Hypertrophy of Prostate. } DR. THOMAS E. CLARKE of Bristol.
 Brit. Med. Journal, Feb. 27, 1875.
- Of Sebaceous Tumour. DR. ALTHAUS.
Brit. Med. Jour., Aug. 28, 1875.
- Of Glaucoma. DR. PECK of Chicago.
 In *Report on Medical Electricity*, No. iv.
 In *The Doctor*, 1873.
- Of Gouty Chalk Stones. DR. ALTHAUS.
Brit. Med. Jour., Aug. 28, 1875.
- Of Hydrocele. DR. MACARIO of Nice, in *L'Abeille Medicale*.
 Quoted in *The Doctor*, Feb. 1877, p. 27.
- Of Ovarian Dropsy. DR. SEMELEDER.
The Doctor, Feb. 1877, p. 28.
- Of Carcinoma and Cancer. DR. NEFTTEL of New York.
 Quoted by M. BENEDICKT of Vienna.
Wien. Med. Press. No. 35, Jahrgang xii.
- Of Warts. DR. HARDAWAY.
 Quoted by *The Doctor*, Nov. 1877, p. 221.
- Of Tetanus. DR. PECK of Chicago.
 In *Report on Medical Electricity*, No. IV.
The Doctor, 1873.
- Of Cramps and Cholera. ,, ,, ,,

Note 14.

9. ELECTRICITY A REMEDY OF DISEASE. (*Continued*).

- Of Stricture of Urethra. DR. ROB. NEWMAN of New York.
American Jour. of Med. Science, Oct. 1875.
Quoted by *Practitioner*, Feb. 1876, p. 153.
- Of Prolapsus Ani. DR. W. B. NEFFTEL of New York.
- Of Prolapsus Uteri. DR. MANN of New York.
Med. Record, April, 1873.
Quoted by *Brit. and For. Med. Chir. Rev.*, April, 1874,
p. 503.
- Of Angina Pectoris. EULENBERG.
BR. BEARD.
Phil. Med. Surg. Rep., May 11, 1872.
- Of Aphonia. DR. PORTER of St. Louis.
Practitioner, Jan., 1875, p. 58.
- „ „ REV. JOHN NANKIVILLE.
The Chantry, Crediton, Devon.
Private Communication.
- „ „ DR. PHILLIPEAUX.
Rev. de Therap. Med. Chir. No. 16, 1867, p. 430.
- Of Amaurosis. SIR BENJ. PHILLIPS.
Newspaper of July 22, 1868.
- Of Asthma. DR. MANCA.
The Doctor, Dec., 1872.
- Of Uterine inaction. DR. A. E. McRAE of Pennicuik.
Edin. Med. Jour., May, 1874, p. 1001.
- Of Bulbar Paralysis. DR. WILHEIM.
Alg. Med. Zeitung.
The Doctor, July, 1876, p. 124.

9. ELECTRICITY A REMEDY OF DISEASE. (*Continued*).

- Of Local Paralysis. DR. BOUCHUT of Paris.
- Of Paralysis Agitans. DR. U. S. L. BUTTER.
Practitioner, Nov., 1869.
- Of Muscular Paralysis. M. LEON LE FORT.
Union Medicale,
Quoted by *The Doctor*, July, 1876, p. 123.
- Of Writer's Palsy. DR. T. BUZZARD of London Paralytic, and
DR. G. V. POORE of Charing Cross Hospital.
Practitioner.
- „ „ DR. RUNGE of Nassau.
The Doctor, Feb. 1874, p. 22.
- Of Lead Palsy. DR. W. B. NEFTTEL of New York.
Clinical Notes on Nervous Diseases of Women.
BROWN-SEQUARD'S *Archives*. No. 3, 1873, p. 270.
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11. IRRITATION A CAUSE OF DISEASE OF DISTANT PARTS.

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 Dr. PAVY.
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11. IRRITATION A CAUSE OF DISEASE OF DISTANT PARTS (*Continued*).

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| Of Diabetes | M. FISHER. |
| „ | from Injury to Brain by Fencing Foil.
BARON LARREY. |
| „ | from Concussion of Brain.
DR. GOLDEN. |
| „ | from Colloid Tumour within Fourth Ventricle.
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Sound Kidney | from Disease of other.
DR. H. W. CARTER of Canterbury.
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BROWN-SEQUARD.
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Stomach

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M. BROCA.

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- Of Zymosis from Injury to Spine.
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11. IRRITATION A CAUSE OF DISEASE OF DISTANT PARTS (*Continued*).^{Note 14.}

Of Congestion of Foot
of Frog

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DR. ABERCROMBIE, and
DR. WELLS.
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DR. EDIS.

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11. IRRITATION A CAUSE OF DISEASE OF DISTANT PARTS (*Continued*).

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 DR. W. A. H. HAMMOND of New York.
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DR. MITCHELL.
- „ from Compression of Vagus.
DR. AUGUSTUS WALLER, F.R.S., of Geneva.
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DR. WILSON FOX.
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- „ from Spinal Irritation.
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- „ from Wound to Sole of Foot.
- „ from Foreign body in Foot.
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Practitioner, June, 1874, p. 451.
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DR. BARNES.
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from Dentition.

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The Library of Medicine, Vol. 4, p. 42.

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from Injury to Nerve.

C. WESTHALL, of Vienna.

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CELIUS AURELIANUS.

Quoted by DR. JAMES.

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DR. GEO. P. RUGG, of Chapham Road, and

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DR. S. J. A. SALTER.

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DR. W. B. CHEEDLE, F.R.C.P.

Of St. Mary's and of Children's Hospital.

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<i>Unity of Disease</i> , edit. of 1839, p. 93. |
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Author. |
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<i>Proceedings of Soc. Med. des Hôp.</i>
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<i>Bonitus</i> , Lib. 1, Sec. 16, Obs. 1. |
| „ | from Concussion.
HILDANUS.
Cent. 5, Obs. 8, p. 389. |
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DR. BROWN SEQUARD.
<i>Brit. Med. Jour.</i> , July 4th, 1874, p. 16 |

11. IRRITATION A CAUSE OF DISEASE OF DISTANT PARTS (*Continued*).^{Note 14.}

- Of Amaurosis from Worms in Intestines.
DR. JOHN MACKINTOSH, of Edin.
Pract. Phys., edit. 3rd, of 1832, Vol. 2, p. 150.
- „ from Splinter of Wood in Carious Tooth.
DR. WATSON.
Med. Times, Nov. 11th, 1865, p. 515.
- „ from Hysteria.
JUNIUS HARDWICK, F.R.C.S., of Rotherham.
Brit. Med. Jour., May 6th, 1876, p. 562.
- Of Dilatation of Iris from Worms in Intestines.
PROF. KUSS.
Quoted by *Brit. and For. Med. Chir. Rev.*, April,
1874, p. 291.
- Of Aphasia from Paracenticis Abdominis.
DR. GUERIN, of Hôtel Dieu.
Quoted by *The Doctor*, Jan., 1873.
- Of Aphonia from Injury to Finger.
DR. LAYCOCK, of Edin.
- „ from Ovarian Tumour.
LAWSON TAIT.
The Hastings Prize Essay.
Brit. Med. Jour., Jan. 13th, 1874, p. 766.
- Of Paralysis of Epi-
glottis from Pressure on Abdomen.
DR. CHAIROND, of Milan.
Gaz. Med. Ital. Lomb.
Quoted by *The Doctor*.

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11. IRRITATION A CAUSE OF DISEASE OF DISTANT PARTS (*Continued*).

Of Paralysis of Re-
spiratory Muscles

from Irritation of Nerves, Cardiacus Longus.

LUDWIG and

CYON.

Quoted by *Practitioner*, April, 1874, p. 249.

Of Palsy of Arms

from Scald of Legs.

DR. JOHN DUNCAN, of Edin.

On Herpes Zoster, p. 245.

Jour. Cutaneous Med.

Of Hemiplegia

from Ear Disease.

DR. HUGHLINGS JACKSON.

Brit. Med. Jour., March 24th, 1877, p. 350.

„

from Cessation of Fit of Gout.

DR. PARRY, of Bath.

Quoted by SIR THOMAS WATSON.

Pract. Phys., 4th Edit., Vol. 2, p. 765.

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from Injury to Right Eye.

DR. SNELLEN.

Archiv. Für Ophthal., Bund. xii. Ab. 1.

Quoted by *Edin. Med Jour.*, June, 1874, p. 1133.

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from Injury to Loins.

DR. LOCKHART CLARKE.

Brit. Med. Jour., July 15th, 1877, p. 77.

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from Constipation.

C. C. WALTER, of Dover.

Brit. Med. Jour., April 1, 1876, p. 418.

11. IRRITATION A CAUSE OF DISEASE OF DISTANT PARTS (Continued). Note 14.

- Of Facial Paralysis from Extraction of Tooth.
T. STEWART NAIRNES, of Glasgow.
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- Of Otagia from Decayed Tooth.
DR. E. WOAKES.
Brit. Med. Jour., Feb. 24th, 1877, p. 231.
- Of Supra Orbital Neu-
ralgia from Dentition.
DR. F. W. NUNN.
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- Of Cephalalgia from Indigestion.
DR. WILLIAM HEBERDEN.
Commentaries, p. 97, of edit. of 1803.
- Of Neuralgia of Heel from Calculus Renalis.
SIR JAMES PAGET.
Brit. Med Jour., May 22nd, 1875.
- Of Severe Pain of Foot from Acidity of Stomach.
SIR BENJ. BRODIE.
Works, Vol. 3, p. 140.
- Of Mania from Lumbricus in Œsophagus.
M. LAURENT, of Marseilles Asylum.
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- „ from Chlorosis.
CÆLIUS AURELIANUS.
Quoted by DR. JAMES.
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Of Hypochondriasis from Gastro-enteritis.

M. BROUSSAIS.

Quoted by DR. C. J. PRICHARD, of Bristol.

Cyc. Pract. Med., Vol. 2, p. 554.

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DR. WM. MURRAY.

On Emotional Disorders, p. 60 and 61.

Quoted by DR. JAMES W. ANDERSON.

Brit. Med. Jour., June 26th, 1875.Of Pervigilium or
Waking Coma

from Dyspepsia.

DR. THOMAS WILLIS, of Ch. Ch. Oxford.

Works. Two Discourses, p. 141.

12. IRRITATION, CURE OF DISEASE OF DISTANT PARTS.

Of Bronchitis, Chronic cured by Herpes Zoster.

SIR THOMAS WATSON.

Pract. Phys., 4th Edit., Vol. ii., p. 935.

Of Pleurisy

cured by Blister down the Arm of same side.

FURNEAUX JORDAN.

Article on a new method of treating Surgical Diseases.

Practitioner, p. 80.

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BAGLIVI of Rome and TRILLER.

quoted by VAN SWIETEN.

Commentaries by DR. SCHOMBERG of Bath, Vol. 4,
p. 346, Edit. of 1774.

Of Rheumatism of
Heart

cured by Compression of Vagi.

DR. AUGUSTUS WALLER, F.R.S.

Practitioner, p. 205.

Of Gout, Fit of

prevented by Diabetes.

DR. GARROD.

quoted by *Practitioner*, Aug., 1876, and p. 126.

Of Periostitis of Elbow cured by Blister to Arm.

DR. HANDFIELD JONES.

Medical Times, April 22, 1876.

Of Ascites

cured by attack of Mania.

RICHARD MEAD, M.D., &c.

Works, Vol. ii., p. 486 of Edit. 1762.

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12. IRRITATION, CURE OF DISEASE OF DISTANT PARTS (*Continued*).

- Of Ulcers of Leg cured by Division of Popliteal Nerve.
HOOKER.
Lancet, 1859.
- Of Kerato Conus, or
Conicity of Cornea cured by an Operation on the other Eye.
DR. CHARLES BELL TAYLOR.
Surgeon to Nottingham Infirmary.
Lancet, June 20th, 1874, p. 869.
- Of Enlarged Glands cured by Erysipelas.
M. MALASSEZ.
Quoted in *The Doctor*, Dec. 1872.
- „ „ cured by large and Distant Blister.
FURNEAUX JORDAN.
Practitioner.
- Of Phthisis relieved by Mania and recurred when Mania ceased.
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- Of Post Partum
Hæmorrhage cured by Irritation of Nipple.
DR. CARMICHAEL.
Edin. Med. Jour., March, 1875, p. 845.
- Of Cutaneous Diseases relieved by Issues and Blisters.
HEBERDEN.
Commentaries, p. 118 of edit. of 1803.
- Of Urticaria cured instantaneously by Mustard Foot Bath.
Tribune Medicale, March 7th.
Quoted by *Practitioner*, Oct., 1875, p. 290.

12. IRRITATION, CURE OF DISEASE OF DISTANT PARTS (*Continued*).

- Of Herpes Zoster cured by Blister on Opposite Side.
 DR. J. R. SPENDER, of Bath.
 Practitioner, 1870. Notes and Queries, p. 255.
- Of Tinea Circinata cured by Erysipelas.
 DR. H. S. PURDON, of Belfast.
 The Doctor, May, 1873.
- " " cured by Fever, *Ibid*.
- Of Lupus cured by Fit of Gout.
 T. L. MILTON, Surgeon to St. John's.
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- Of Vomiting cured by Pressure on Vagus.
 DR. H. C. HAND.
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- Of Epilepsy cured by seton at back of Neck.
 DR. THOS. J. GRIFFITHS of Louisville Ky.
 Amer. Pract. for March.
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- " DR. GRAHAM N. FITCH of Indiana.
 Ibid.
- " cured by Ague.
 HIPPOCRATES.
 Aph. 4, Section No. 57.
- " DR. GRAHAM of Edin.
 Quoted by SIR THOMAS WATSON.
 Pract of Med. Vol. i., p. 772. Edit. 4th.

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12. IRRITATION, CURE OF DISEASE OF DISTANT PARTS (*Continued*).

- Of Convulsions cured by Tickling.
WARDROP.
Quoted by DR. SAM'L. DICKSON.
In *Unity of Disease*. Edit. of 1839, p. 93.
- Of Suspended Respiration.
 cured by Irritation of Larynx.
DR. H. B. CLARKE of New Bedford, Massachusetts,
U. S.
Quoted by *Practitioner*, March, 1875, p. 208.
- Of Hysteria cured by Fever.
DR. JAMES.
Medical Dictionary, 1745, art. *Pyretos*.
- Of Tinnitus Aurium of
seven years duration cured by Herpes Zoster.
SIR THOMAS WATSON.
Pract. Phys., 4th Edit., Vol. ii., p. 935.
- Of Headache in Fever cured by Blister between the Shoulders.
HEBERDEN.
Commentaries, p. 176 of Edit. of 1803.
- Of Hemicrania Periodical
 cured by Compression of Vagi.
DR. AUGUSTUS WALLER, F.R.S.
Practitioner, p. 205.
- Of Neuralgia Trifacial cured by Cauterization of Lobe of Ear.
A. TROUSSEAU.
Clinical Medicine, Vol. i., p. 510 of *Syd. Soc.*

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- Of Neuralgia Trifacial cured by Dilatation of Os Uteri.
DR. ELLENGER, of Stuttgart.
Archiv. für Gynækologie, Vol. v., fasc. 2, 1873.
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DR. SNELLEN.
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RICHARD GREEN, of Hayward's Heath.
Practitioner, March, 1874, p. 189.
- „ cured by Injury to Spine causing Paralysis.
Brit. Med. Jour., Aug. 29th, 1874, p. 283.
- Of Amnesia cured by Cauterization of Pharyngeal Mucous Mem-
brane.
M. BITOT.
Archives Generales de Med., Dec. 1876.
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13. PASSION, A CAUSE OF DISEASE

Of Synochus Simplex

or Ephemeral fever from sudden Passion of the Mind.

DR. THOMAS WILLIS of Christ Church Oxford.

Works, part i., p. 91. Edit. of 1681.

Of Fever and Delirium from Joy.

DR. C. H. JONES.

Journal of Mental Science, July, 1870.

Of African Fever

from Depressing Emotion.

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Medical Times, Oct. 17, 1863.

Quotation from Baker's Journal.

Of Congestive Fever

from Depressing Emotion.

DR. JOHN MACKINTOSH.

Pract. Med., Edit. of 1832, Vol. i. p. 162.

Of Puerperal Fever

from Mental Shock.

DR. C. WEST.

Obstet. Soc., July 7.*Brit. Med. Jour.*, July 24th, 1875.

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DR. BRAXTON HICKS.

Brit. Med. Jour., June 12, 1875, p. 780.

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from Mental Emotion.

DR. EDWARD JOHN TILT.

Brit. Med. Jour., Sept. 4, 1875, p. 294.

Of Milk Fever.

SIR CHARLES LOCOCK, M.D.

Cyc. Pract. Med., Vol. iii., p. 12, Edit. of 1833.

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- Of Hectic Fever from Emotion.
M. BOUCHUT.
Quoted in *Brit. and For. Med. Chir. Rev.*, Oct. 1872,
p. 352.
- Of Pericarditis from Grief and Anxiety.
DR. JOHN MACINTOSH, of Edin.
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- Of Pneumonia in Rabbit from fright.
DR. HOLLAND of Sheffield.
Edit. of 1829, *Experimental Inquiry into the Laws of
Organic and Animal Life*, p. 24.
- Of Peritonitis from Emotion.
DR. J. BATTY TUKE.
3rd Morisonian Lecture.
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- Of Enteritis in Rabbit from Fright.
DR. HOLLAND, of Sheffield.
*Experimental Enquiry into the laws of Organic and
Animal Life*, Edit. of 1829, p. 24.
- Of Gastritis from Powerful Emotion.
DR. T. H. TANNER.
Pract. Med., Seventh Edit., Vol. ii., p. iii.
- Of Gastritis, Chronic from Mental Excitement.
DR. A. TWEEDIE.
Library of Medicine, Vol. 4, p. 61.

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13. PASSION, A CAUSE OF DISEASE (*Continued*).

- Of Cerebritis from Grief or Fear.
MR. QUAIN, and
DR. ADAIR CRAWFORD.
Cyc. Pract. Med., Vol. 1, p. 309.
- Of Meningitis from Fright.
DR. JOHN MACKINTOSH, of Edin.
Pract. Phys., Vol. 2, p. 28, Edit. of 1832.
- „ from Fright or Violent Emotion.
PROFESSOR JONES QUAIN of London University.
Cyc. Prac. Med., Vol. i. p. 287.
- Of Congestion of Brain from Violent Emotion or Prolonged Mental Effort.
DRS. RUSSELL REYNOLDS and CHARLTON BASTIAN.
System of Medicine, Vol ii., p. 419.
- Of Arteritis from Violent Mental Emotion.
DR. A. TWEEDIE.
The Library of Medicine, Vol. iv., p. 7.
- Of Flow of Saliva. from Emotion at Sight of Food.
A. MITCHELL.
Commissioner in Lunacy for Scotland.
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DR. SAMUEL WILKS, of Guy's.
Med. Times, Jan. 11th, 1868.
- „ from Emotion.
Editor of *Brit. Med. Jour.*, Nov. 27th, 1875.
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DR. BENICE JONES, 1869.

13. PASSION, A CAUSE OF DISEASE (*Continued*).

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from Emotion and Anxiety.

DR. STEPHEN H. WARD, and

DR. S. O. HABERSHON,

In *Lettsomian Lectures*, for 1872.Quoted in *Brit. and For. Med. Chir. Rev.*, April, 1875,
p. 363.

„

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DR. STEPHEN H. WARD.

Brit. and For. Med. Chir. Rev., April, 1873, p. 264.

„

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J. RUSSELL REYNOLDS.

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DR. THOMAS TROTTER.

A view of the Nervous Temperament.

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from Passions of the Mind.

DR. THOMAS WILLIS, of Oxford.

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from Mental Exertion.

SYDENHAM.

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Cyc. Prac. Med., vol. ii. p. 363, Edit. of 1833.

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from Grief.

LAENNEC.

Quoted in GRAHAM'S *Domestic Medicine*, p. 372, of
13th edit.

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13. PASSION, A CAUSE OF DISEASE (*Continued*).

- Of Diarrhœa from Agitation of Mind.
 DR. JOHN CRAMPTON, of Dublin.
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- " from Mental Impression.
 DR. F. W. PAVY, F.R.S.
 Treatise on the Function of Digestion, p. 195.
- " from Mental Emotion.
 DR. J. MILNER FOTHERGILL.
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- " from Fright.
 SIR THOMAS WATSON.
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- " from Alarm.
 SURGEON MAJOR ROBERT PRINGLE, Bengal Army.
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- " BUTLER'S *Hudibras*.
- " in Infant—from Fright of Mother.
 DR. J. J. RIDGE.
 Med. Times, Sept. 2nd, 1871, p. 273.
- Of Diabetes from Emotion.
 DR. W. HOWSHIP DICKINSON.
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- Of Gastric Ulcer from Nervous Depression or Anæmia.
 PROF. SEBERT, of Zurich.
 Medical Examiner, Aug. 2nd, 1877.
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- Of Menorrhagia from Emotion.
 DR. A. TWEEDY.
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- „ from Mental Shock.
 DR. SUTHERLAND, St. George's Dispensary.
 Brit. Med. Jour., April 14th, 1877, p. 454.
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 DR. A. MITCHELL.
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- Of Sudoresis from Fright.
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 DR. DUCKWORTH.
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- Of Apoplexy from Perturbations of Mind or Fright.
 VAN SWIETEN.
 Commentaries by SCHOMBERG, Vol. 4, p. 358, Edit. of
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- Of Cerebral Hæmorrhage from Vexation.
 HAMMOND of New York.

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13. PASSION, A CAUSE OF DISEASE (*Continued*)

- Of Thrombosis from Fright.
 DR. THOS. S. DOWN of Highgate.
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- Of Fatal Cholera from Depressing Emotions.
 PROF. LAURA of Turin.
 Med. Times, Feb. 15, 1868.
- Of Granular Kidney from Mental Anxiety.
 DR. CLIFFORD ALLBUTT of Leeds.
 Practitioner, Nov. 1874, p. 320.
 ROBERT P. OGLESBY, M.R.C.S. of Leeds.
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 EDITOR.
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 DR. HABERSHON.
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 p. 363.
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 DR. DEBOUT D'ESTREES.
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 Brit. Med. Jour., May 12, 1877, p. 585.
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 SIR THOMAS WATSON.
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 Editor of *Brit. Med. Jour.*, Nov. 27, 1875.

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- „ TRISTRAM SHANDY, gent.
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 DR. SAM. WILKS of Guy's.
- „ from Depressing Emotions from Bad News.
 CAPT. FRED. BURNABY.
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 DR. W. H. BROADBENT of St. Mary's.
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- „ from Mental Emotion.
 DR. A. TWEEDIE.
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 fant from Fright of Mother.
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13. PASSION, A CAUSE OF DISEASE (*Continued*).

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Infant

from violent Excitement of Mother.

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Milk

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J. P. DICKSON, of St. Luke's.

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T. SPENCER WELLS on

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„

from violent Emotion.

DR. DUCKWORTH, and

DR. LAYCOCK.

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„

from Mental Emotion.

SIR CHARLES LOCOCK.

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Vomiting

from Mental Shock, and following remote Concussion
of Spine.

DR. R. LOWTHER, of Cartmel.

Brit. Med. Jour., Jan. 19th, 1878, p. 90.

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from Bad News.

DR. CLEMENT DUKES, B.S., of Rugby.

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PROF. ERASMUS WILSON, F.R.S.
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DR. BALMANNO SQUIRE.
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PROF. ERASMUS WILSON, F.R.S.
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neous Statistics*.
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DR. BEN. W. RICHARDSON.
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MARSHALL HALL.
Quoted in *Brit. and For. Med. Chir. Rev.*, July, 1873,
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DR. H. RADCLIFFE CROCKER of University College Hos-
pital.
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| Herpes and Zona | from want of Nerve Supply.
DR. CLIFFORD ALLBUTT.
<i>Practitioner</i> , Nov., 1874, p. 320. |
| Of Eczema | from Mental Anxiety.
DR. BALMANNO SQUIRE.
<i>Private Communication</i> , Jan. 12, 1874. |
| „ | from Mental Anxiety and Grief.
PROF. ERASMUS WILSON, F.R.S.
<i>Portraits of Skin Diseases</i> . |
| Of Alopecia Areata | from Mental Emotion.
DR. JAMES CUMMING of Edinburgh.
<i>Practitioner</i> , Feb., 1878, p. 111. |
| Insular Sclerosis | from Vivid Emotions.
PROF. CHARCOT.
<i>Brit. and For. Med. Chir. Rev.</i> , Oct. 1875, p. 297. |
| Of Dermato-Melasma }
Bronzing of Skin } | from Emotion.
MEISNER.
Quoted by DR. E. HEADLAM GREENHOW of Middlesex
Hospital.
<i>Brit. Med. Jour.</i> , April 3, 1875, p. 440. |
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ADDISON. |
| Of Horripilation | from Eating Sour Apple. |
| Of Tetanus | from Fright.
DR. HENNEN, and
DR. WILLAN.
<i>Cyc. Pract. Med.</i> , Vol. 4, p. 674 |

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Of Opispleuros Tho-
tonos.

from Emotion.

DR. THOS. S. DOWN, of Highgate.

Brit. Med. Jour., Jan. 13th, 1877, p. 38.

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T. W. LORINSER.

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from Passions of the Mind.

DR. JOHN MACKINTOSH, of Edin.

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or Starting

from Surprise.

DR. JOHN FLETCHER.

General Pathology.

Of Writer's Cramp

from Emotion.

DR. G. V. POORE.

Practitioner, July, 1873, pp. 8 and 10.

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Valves

from Mental Emotion.

DR. J. W. DA COSTA, of Philadelphia.

Third Tonar Lecture.

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from Violent Emotion.

JOS. MITCHELL.

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Of Epilepsy

from Emotion.

Brit. and For. Med. Chir. Rev., July, 1873, p. 117.

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13. PASSION, A CAUSE OF DISEASE (*Continued*).

- Of Epilepsy from Fright.
DR. C. R. DRYSDALE.
The Doctor, Nov., 1873.
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HEBERDEN.
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Jour. de Medicin.
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- Of Hysteria from Imitation.
DR. JOHN FLETCHER of Edinburgh.
- „ from Mental Impression.
DR. HOWSHIP DICKINSON, F.R.C.P.
Brit. Med. Jour., Oct. 16, 1875.
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Pass, with a gaping wonderment,
A fool's device—“ Why who would think”—
Commit it safe by pen and ink
What'er deserves attention, now,
For when 'tis past, you know not how,
Too late you'll find out to your cost
So much of human “ LIFE ” is lost.”

JOHN BYROM, F.R.S.

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