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from the Author.

ESSAYS

ON THE

PHILOSOPHY OF VITALITY

AS CONTRADISTINGUISHED FROM

CHEMICAL AND MECHANICAL PHILOSOPHY,

AND ON THE

MODUS OPERANDI

OF

REMEDIAL AGENTS.

BY

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"The Lord God FORMED man of the dust of the ground; and BREATHED into his nostrils the breath
of life and man BECAME a LIVING soul."—GENESIS.

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PHILOSOPHY OF VITALITY

CHEMISTRY AND PHYSIOLOGICAL THEORY

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PHILOSOPHY OF VITALITY

MARTIN BARRÉ & W. B. D.

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THE FOLLOWING ESSAYS ARE RESPECTFULLY DEDICATED TO

PROF. J. MULLER, M.D.

A. P. W. PHILIP, M.D. F.R.S.

AND

MARSHALL HALL, M.D. F.R.S.

AS A HUMBLE ACKNOWLEDGMENT OF THE AID WHICH THE AUTHOR

HAS DERIVED FROM THEIR LUMINOUS RESEARCHES INTO

THE PHILOSOPHY OF THE NERVOUS SYSTEM.

PREFACE.

WHEN great principles are invaded by error, it is not less the duty, than the right, of the conservative portion of society to come to their protection; nor can error complain that it is not permitted to move on unmolested. It must be ever willing to take its chance in a conflict with truth.

The tendency of the labours now in progress in organic chemistry to the subversion of physiological science, and therefore of pathological and therapeutical principles, and, as another necessary consequence, of rational practice, induces me to persevere in contributing my humble efforts to counteract the influence of the iatrochemical philosophers. However laudable may be their motives, and however they may astonish us with revelations in inorganic chemistry and multiply the sources of human happiness, they are nevertheless employed, in their interpretation of "facts" relative to organic chemistry, in opposition to the experimental results which have been forever in undeviating progress in every individual of the organic kingdoms. The enchantments, however, of a fascinating pursuit, and an imperfect acquaintance with those profound institutions of nature which are entirely foreign to the laboratory, and which can only be known through the accumulated inquiries of ages into both the natural and morbid phenomena of organic beings, must be allowed the weight

of an apology. But, an attempt to overthrow the experience of the past, and to obscure what is written in the most legible characters, and, as it were, in thousands of languages, upon the tablets of organic life, by a distorted construction of "*facts*" which are yielded by test glasses and crucibles, appears to me to be an enterprise which should alarm physiologists as to its pernicious consequences.

That we are on the eve of some vast convulsion in physiology, can no more be doubted by those who watch the signs of the times, than that the declaration has been promulgated, *ex cathedra*, that "medicine is now in its infancy," or that efforts were made to establish a spurious system upon that assumption.

"*Animal and vegetable* physiologists," says the able Liebig, "institute experiments without being acquainted with the circumstances necessary for the continuance of life, — with the qualities and proper nourishment of the animal and plant on which they operate, — or with the nature and chemical constitution of its organs. These experiments are considered by them as convincing proofs, whilst they are fitted only to awaken pity." — (LIEBIG.)

The question then is, whether "*animal and vegetable* physiologists" will continue to be satisfied with the "experiments and the *pity*" of the *chemical* physiologists? How this question will be decided, I can entertain no doubt if the reader will attentively examine the article on "Poisons, Contagions, and Miasms," in Liebig's Organic Chemistry applied to Agriculture and Physiology, extending from page 329 to 384; — which is certainly the most stupendous exhibition of perverted facts, of combinations of conflicting doctrines, and of the rudest system of pathology and therapeutics, that can be found in the records of dreamy speculation. And yet is Liebig profound and rich in *chemical philosophy*, and in its application to the useful arts.

I will take this opportunity of making a few explanatory remarks relative to a communication from the Editor of the British and Foreign Medical Review, which appeared in an April number of the Boston Medical and Surgical Journal, since they are necessary to a just understanding of the case.

Dr. Forbes having refused to impart to the public the name of any individual as the author of the "plagiarisms" in his Journal, and having stated that he had "sent the name of the real author of the plagiarisms to a mutual friend in New-York, with permission to mention it to Dr. Paine in confidence," it seems indispensable that I should say,—that this communication was not made to me until a considerable time after the publication of my Reply to Drs. Forbes' and Carpenter's Circular Letters, and that it was then done with the strictest injunction of secrecy, and with the information from Dr. Forbes, that the individual had gone to *Australia*. The reader should be likewise in possession of the fact that I have received information from a sure source in Europe, that Dr. Forbes has stated that Dr. Carpenter wrote a part of the Review of my Commentaries, and the "plagiarist" the other part! (1)

I would also add, that the author of the Examination of Reviews has never "*sought to crush*," as assumed by Dr. Forbes, "*with the thunders of his gravis-epistola, the British and Foreign Medical Review, and all belonging to it*;" but simply to protect his own rights, and to administer, as far as might be, exact justice to all. And now, in conclusion of the whole subject, and in consideration of the honour which Dr. Forbes has done me of republishing in his late communication a brief commendatory notice of his Journal which was granted by me on application, I will do myself the farther honour of

(1) Did the "Plagiarist" write *his* part of the review of my "Commentaries" before or after his migration to Australia?

saying, that, when Dr. Forbes communicated to me the name of the foregoing inhabitant of *Australia*, he also conveyed an invitation to enrol myself as a Reviewer in the "British and Foreign Medical Review;" a privilege of which I intend to avail myself should Dr. Forbes become an author.⁽¹⁾

New-York, June 12, 1842.

(1) Perhaps it is admissible to show, that, whilst my labours were undergoing misrepresentations in London, they were treated with magnanimity in a country which is præeminent in medical philosophy, as in all other learning, which is foreign in its language and political institutions, and where I had no friend at court, — not even an acquaintance.

The following extract from the Boston Medical and Surgical Journal of June 8th, embraces a statement of the honour to which I refer :—

"In the printed catalogue of the members of the Prussian Medical Society for June, 1841, (*Verein für Heilkunde in Preussen*,) is the name of Martyn Paine, M. D. of New-York, extensively known in the medico-scientific world, for his indefatigable industry in medical literature. This Society embraces the élite of the medical faculty of Prussia and Germany, there being but one hundred and fifty ordinary members — and till the election of Dr. Paine, it had not conferred the honour of a diploma on a single person in America."

ESSAYS ON VITALITY,

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“THESE difficulties, the solution of which gives medicine its highest character as a science, can be adequately conceived by the medical man alone. Neither those accustomed to legal evidence only, nor such as have pursued physical science in its more simple material forms, can rightly apprehend the vast difference made by the INTRODUCTION of the PRINCIPLE of life, or, yet more, of the states and phenomena of mind, in connexion with bodily organization. We have here a NEW WORLD of relations, occult and complex in their nature, to be reasoned upon and resolved; with a principle of change, moreover, ever operating among them, which makes all conclusions liable to a new source of error. It is the want of this *right understanding* of medical evidence, which makes the mass of mankind so prone to be deceived by imposture of every kind; whether it be the idle fashion as to particular remedies; or the worse, because wider deception of some system, professing to have attained, at once, what the most learned and acute observers have laboured after for ages in vain.” — HOLLAND. *Medical Notes and Reflections*, p. 2.—1840.

“Until it is proved that the FORCES which, in a living body interrupt the play of the natural chemical affinities, *maintain a proper temperature, and preside over the various actions of organic and animal life*, are analogous to those admitted by natural philosophy, we shall act consistently with the principles of that science, by giving distinct names to those TWO KINDS of forces, and employing ourselves in calculating the DIFFERENT LAWS they obey.” — ANDRAL. *Pathological Anatomy*, vol. i, p. 422.

“Physiology would have made a much greater progress, if all those who studied it had set aside the notions which are borrowed from the accessory sciences, as they are termed. But these sciences are not accessory; they are wholly strangers to physiology, and should be banished from it wholly.” “To say that physiology is made up of the *physics* of animals, is to give a very absurd idea of it. As well might we say that *Astronomy* is the physiology of the stars.” — BICHAT. *General Anatomy, &c.*

“We would be glad to see the science of physiology based upon a more extensive generalization of the phenomena of VITALITY than has usually been thought necessary.” — BRITISH AND FOREIGN MED. REV., vol. iv, p. 285, &c.

“In endeavouring to explain any of those phenomena (of organic beings) which have hitherto evaded research, it may be anticipated, that if such inquiries be successful, they will not lead to the discovery of any new laws, but unfold the same simplicity of means for performing those operations of the economy which have already been discovered.” — WARDROP. *On the Nature and Treatment of Diseases of the Heart, Part I*, p. 13.

"Hippocrates totam suam philosophiam in hoc posuit, quod res congeniæ se mutuo appetant, dissimiles vero a se invicem recedant."—KEILL. *Med. Stat. Brit.* p. 32.

"The establishment of just principles, besides being the proper end of observations and facts, is certainly what confers upon them their highest value."—SENAC. *On Fevers.*

"The actions of living beings, whether normal or abnormal, are as amenable to general laws as those of inert matter; and the discovery of these laws is within the reach of those who search after them in the right track."—BRITISH AND FOREIGN MED. REV., vol. vi, p. 110.

"Although throughout nature nothing really exists but individual bodies having simple individual actions, according to a law, (edentia actus puros ex lege;) yet in every thing, that law, and the tracing, finding out, and explaining it, is the foundation of science and experiment."—BACON. *Nov. Organ. l. ii, Aph. 2.*

"Too many facts crowd the memory without advantage, any farther than they lead us to establish principles."—HUNTER. *Lectures on the Principles of Surgery,* p. 8.

"We have had workmen enough to toil in the mine and quarry. They have raised and roughly fashioned an abundance of materials."—LAWRENCE. *Lectures on Physiology,* p. 65.

"I have done my part by mentioning the indications to be considered, and pointing out the time and manner of doing it; for the practice of physic consists chiefly in being able to discover the true curative indications, and not medicines to answer them; and they who have overlooked this point, have taught empyrics to imitate physicians."—PREFACE to SYDENHAM'S *Works.*

"Those who are incapable of generalizing seek in books for particular details only. Every author, therefore, who does not tell them all they are ignorant of will appear to them unworthy of being read."—ZIMMERMANN. *Experience in Physic.*

"Theory is only common sense applied to calculation."—LAPLACE.

"We must never forget that it is *principles*, not phenomena, *laws*, not insulated independent facts, which are the objects of inquiry."—HERSCHELL'S *Discourse, &c.*, p. 13.

"A single just principle in our science will lead to more truth, in one year, than whole volumes of uncombined facts will do in a century."—RUSH. *Medical Inquiries,* vol. iv, p. 43.

I PURPOSE, in this paper, stating some original views relative to the doctrines of life as contradistinguished from those which respect inorganic nature. These doctrines lie at the foundation of all medical philosophy, of all practical medicine.

I shall proceed, in the first place, to carry out the illustration of an important, and fundamental principle of nature, as briefly set forth in my "Examination of Reviews." This exposition occurs at the 33d page of that work, and consists in a deduction

of the doctrines of the vitalists from the phenomena that attend the development of the incubated egg.

It is also one of my present objects to extend the application of the foregoing principle, and to consider,

1st. The constitutional nature of the ovum.

2d. To show farther by the philosophy of generation, and by the nature of the powers which are universally admitted to be alone concerned in developing the germ or ovum, and in forming the organs of the new being, that the *same* powers are, also, *alone* concerned in carrying on forever afterwards the processes of life, and, of course, that no new powers, or principles, are introduced.

3d. To consider the manner in which the germ is impregnated, or its vital properties so stimulated into action, as to result in the development of the germ, and in unfolding the various attributes of the new being.

4th. To show that we may find in the physiology of generation, or the principles through which the ovum is impregnated, the whole philosophy of organic life, or the principles through which the actions of life are forever carried on.

5th. To state the manner in which the natural peculiarities of each parent, whether as it respects the properties of life, or the physical conformation, are infused into the germ and combined in the full-grown offspring.

6th. To show that hereditary diseases are transmitted in the same way as those more natural peculiarities which belong to parents.

7th. To show, also, that the principles which are concerned in the transmission of hereditary diseases are the same as concur in the production of ordinary diseases.

8th. To deduce from the philosophy of generation the vital nature of hereditary diseases; or, in other words, to show that the morbid impression is established upon the vital properties of the ovum, and of course, upon those of the new being; and that the hereditary vitiation does not consist in any transmitted impurity to the blood or other fluids of the offspring, as is now supposed by the humoralists, and the fallacy of which I have endeavoured to establish in my Essay on the "Humoral Pathology."

In considering the questions before us, we are but employed in tracing nature into one of her thousand labyrinths, whose ex-

ploration only requires us to avoid speculation and take nature for our guide; and here it must be our first object to interrogate her as to the constitution of the ovum, that we may ascertain by what powers its development is accomplished. At this elementary step of our being, no philosophical mind can doubt that all the component parts of organic beings are wholly different from the ordinary combinations of chemistry, and, therefore, that they are effected by powers with which chemistry has no connexion. Such being granted, analogy does the rest for the whole organic fabric.

If we go to the elementary constitution of organic beings in their state of maturity, we shall at all times find in the *modes* and *proportions* in which their elements are united, the same fundamental proof that they are combined and held in union by properties and laws peculiar to beings so constituted; and what is thus at the very foundation of organic compounds, must pre-empt over all subsequent developments and actions.

Let us hear the illustrious Müller upon the elementary constitution of organic beings, who, in inclining to the doctrines of the chemists in his interpretation of the general results of organic processes, will be allowed to have been prompted alone by a love of truth in a statement so adverse to his subsequent conclusions, and by convictions that could only have flowed from the most elaborate inquiry.

“The peculiarity of organic matter,” says Müller, “depends probably on the following circumstances, first pointed out by Berzelius and Fourcroy :

“1st. In mineral substances the elements are always combined in a binary manner; thus, two elementary substances unite together, and this binary compound unites again with another simple substance, or with another binary compound.” “In minerals the elementary substances are never observed to combine three or four together, so as to form a compound in which each element is equally united with all the others. This, however, is universally the case in organic bodies. Oxygen, hydrogen, carbon, and nitrogen, the same elements which by binary combinations formed inorganic substances, unite together, each with all the others, and form the peculiar proximate principles of organic beings. These compounds are termed ternary, or quaternary, according to the number of elements composing them.” (MULLER'S *Elements of Physiology*, vol. 1, p. 2.)

It is true, certain organic chemists having seen that such a constitution of organic nature would be fatal to the whole chemical philosophy of life, have not only rejected the doctrine by

the force of analogy as derived from the composition of oxalic acid, and one or two other compounds which are themselves obtained by direct chemical agencies, and therefore more or less artificial, but, as we have seen on a former occasion, they have assumed the prerogative of Almighty Power in the creation, not only of organic compounds, but of the entire animal; whilst one of the most eminent gravely entertained a society of philosophers in Edinburgh with the discovery of a process for transmuting cyanogen, (compounded of nitrogen and carbon,) into the simple element, silicium. Müller notices and rejects the assumptions of the chemists relative to the few compounds which they declare to be organic, and yet composed of only two elements. Of urea, he very justly remarks, that "it can scarcely be considered organic matter, being rather an excretion than a component of the animal body." I shall only add upon this subject, that however urea may be obtained, either from the urine or other compounds, its elaboration, whether spontaneous or artificial, is not a proof of its previous existence in that particular condition; whilst the agencies employed for its production necessarily involve important changes in the original compound. This principle is obviously more or less applicable to all the chemical experiments which are instituted upon organic compounds.

I shall not advert to the remaining contradistinctions between organic and inorganic beings, beyond what relates immediately to the specific inquiry before us.

"*The only character,*" says Müller, "*that can be possibly compared in organic and inorganic bodies, is the mode in which symmetry is realized in each.* (MÜLLER'S *Physiology*, p. 21.) Tiedemann, too, was right in saying that, "all the qualities of organic bodies should be looked upon as the effects of the vital powers. Even those phenomena seen in them, which they exhibit in common with inorganic bodies, undergo modifications of their specific action, and should be considered subordinate to the vital powers."

But, we are now especially interested about the opinions of philosophers as to the entire dependence of the development of the ovum upon a vital principle or vital properties; for if this point be universally conceded as a matter of course, then it will follow that it is the same principle or properties which are forever afterwards concerned in organic processes, and *alone* concerned. Tiedemann goes on thus:

"It is the *vital power*, which in the fecundated germinative liquid, brings the

molecules of the organic combinations to the solid form, and calls the first lineaments of the vegetable and animal embryo into existence. All the parts and tissues that are formed in it, according to a definite order of succession, are products of the power of formation, and on this they depend in all that relates to their first appearance, their development, aggregation, configuration, and arrangement. The phenomena exhibited in the act of formation of an embryo, are placed far above all the mechanical and chemical acts we observe in bodies not endowed with life," — (TIEDEMANN. *Comparative Physiology*, p. 185.)

"The creative force," says Müller, "exists already in the germ, and creates in it the essential parts of the future animal. The germ is *potentially* the whole animal. During the development of the germ, the *essential parts* which constitute the actual whole are produced." "The entire vital principle of the egg resides in the germinal disk alone; and since the external influences which act on the germs of the most different organic beings are the same, we must regard the simple germinal disk, consisting of granular amorphous matter, as the *potential whole* of the future animal, endowed with the *essential* and *specific force* or principle of the future being, and capable of increasing the very small amount of this *specific force* and *matter* which it already possesses, by the assimilation of new matter." And again he says, "this force exists before the harmonizing parts, which are, in fact, formed by it during the development of the embryo." "The vital force inherent in organic beings *itself* generates the essential organs which constitute the whole being." "The formative or organizing principle is a *creative power*, modifying matter blindly and unconsciously;" yet with such wonderful precision, that Müller also says, that "this *rational* creative force is exerted in every animal strictly in accordance with what the nature of each requires." "The vital principle," he says, is in a quiescent state in the egg before incubation." (1) (MÜLLER'S *Elements of Physiology*, p. 23.)

Roget, of high authority, maintains that

"We are not warranted in the assertion that the operations of vital chemistry are directed by distinct laws, and are the results of new agencies;" and he condemns the opinion as to "a principle of vitality" as "a *fiction of the mind*." (ROGET'S *Outlines of Physiology*, ch. 4, p. 64.)

But, all this, (as with every enlightened chemical physiologist,) is contradicted whenever he touches specifically upon any of the actions or other results of life. There is a perpetual recurrence of "vital powers," "vital actions," "vitality," &c., in

(1) The applicability of the following important statement to my Essay on the "Vital Powers," and to the subject of "force," "properties," and "vital principle," as investigated in my "Examination of Reviews," (p. 8—34) is sufficiently obvious.

"Whether the vital principle," says Müller, "is to be regarded as IMPONDERABLE MATTER, or as a FORCE OR ENERGY, is just as uncertain as the same question is in reference to several important phenomena in physics. Physiology, in this case, IS NOT BEHIND the other natural sciences; for the PROPERTIES OF THIS PRINCIPLE in the functions of the nerves are nearly as well known as those of light, caloric, and electricity, in physics." (MÜLLER. *Ibid.* p. 27.)

both of the able physiological works of this author. Even in respect to the composition of animals, "the mode," he says, "in which their elements are combined is so complex as to require a long and elaborate process to accomplish that purpose; and neither the organs with which animals are furnished, *nor the powers* with which those organs are endowed, are adequate to the conversion of the materials furnished by the inorganic world into the substances required for the construction of their bodies, and the maintenance of their powers. The inorganic elements must have passed through intermediate stages of combination," in the vegetable kingdom, &c. And yet the chemical physiologists assume that *animal* compounds may be created in the laboratory!

Let us now hear this able writer on the subject of fœtal development.

"The utmost solicitude," he says, "has been shown in every part of *living* nature to secure the perpetuity of the race, by the establishment of laws, of which the operation is certain in all contingent circumstances."

"A portion of the VITAL POWER of the parent," he says, "is employed to give origin and birth to the offspring, and certainly no part of the economy of animated nature is more calculated to impress us with exalted ideas of the immensity of the scheme of Providence. Nothing can be more admirable than the progressive architecture of the frame," &c. Roget ultimately describes, in his usual felicitous manner, the development of the ovum, and here we have nothing from our author but the agency of "*the vital powers.*"

"The foundations of the edifice," he says, "are laid in the homogeneous jelly by the EFFORTS of the VITAL POWERS." "At first all the ENERGIES of VITALITY are directed to raising the fabric, and to the extension of those organs which are of greatest immediate utility;"—and so on throughout the chapter; the whole work of developing and fashioning the fœtal organs being assigned to "the Efforts of the Vital Powers," and to "the Energies of Vitality." (ROGET'S *Animal and Vegetable Physiology*, vol. 1, pp. 42, 45; vol. 2, p. 424.)

We have thus before us a plain statement of our necessary premises as they respect the exclusive agency of the "vital principle," or "organic force," or "creative power," or "vital properties," or "vital powers," or "*vitality*," (which-ever term may be preferred,) in carrying out the full development of the embryo.

But let us hear, also, Dr. Carpenter, who advocates the chemical doctrines of life, so far as to lay down the following principle no less than twice within six pages, and in nearly the same words.—Thus:—

“Reason,” he says, “has been already given for the belief that the affinities which hold together the elementary particles of organized structures, are not different from those concerned in the inorganic world; and it has been shown that the tendency to decomposition after death bears a very close relation with the activity of the changes which take place in the part during life”! (*Carpenter's Principles of General and Comparative Physiology*, p. 140; also p. 146.)

Now the authority of such a writer, and the acknowledged head of the strictly chemical school in physiology, must be allowed to be very important when any concession is made to vitalism. Let us then hear him in the matter of the ovum.

“Organization and *vital properties*,” he says, “are simultaneously communicated to the germ by the structures of its parent.⁽¹⁾ These vital properties confer upon it *the means* of itself assimilating, and thereby *organizing* and ENDOWING with VITALITY, the materials supplied by the inorganic world.”⁽¹⁾ (*CARPENTER'S Principles, &c.*, p. 138.)

Dr. Prichard is strictly of Dr. Carpenter's school, (see my “Examination,” &c., p. 37,) and as the writings of the latter upon the vital principle are but a reiteration of those of the former, I have hitherto thought it unnecessary to cite the language of both, and have preferred Dr. Carpenter's as the latest exposition of the strictly chemical and physical creed. But, there is a point of agreement which is worth noticing in its connexion with the subject now before us, and to which I formerly referred, in its relation to Dr. Carpenter. Both of these writers see so much of peculiar design in organic nature, that they find it impossible to interpret the phenomena of organic beings upon the chemical and physical principles which they have so strenuously put forth, and, in the end assign them to the *immediate* action of the Deity. But, let us have an example to our direct purpose. Thus:—

“The theory of a vital principle,” says Dr. Prichard, “has been applied in a different manner, to account for the phenomena displayed at the beginning of life in animals and vegetables, and to get rid of the mystery which attends the gradual evolution of organic structure from ova and germs. Here the vital principle is no longer considered as a chemical agent, but assumes the character of a plastic or formative power,” &c.

(1) And yet Dr. Carpenter says that the vital properties exist in the *elements* of matter. “A writer who can so contradict himself [and on fundamental doctrines] scarcely needs to be exposed by us.”—See *Dr. Carpenter's review of my “Commentaries”* and my “*Examination of Reviews*,” pp. 12, 37, 86, &c., and my “*Notice of Reviews*,” p. 2.

Now, then, how does Dr. Prichard "get rid of the mystery"? In the following way, namely, —

"We may," he says, "if we choose to do so, term *the cause* which governs the organization and *vital* existence, a plastic principle, but it is a principle ENDOWED WITH INTELLIGENCE AND DESIGN [!]. It is, in fact, nothing more than the Energy of the Deity." "The development of forms, according to their generic, specific, and individual diversities, not less in the vegetable than in the animal world, can only be accounted for by ascribing it to the universal energy and wisdom of the Creator." (PRICHARD'S *Review of the Doctrine of a Vital Principle*, pp. 123, 141. — See, also, *Paine's Commentaries*, vol. 1, pp. 10, 25; and his *Examination of Reviews*, pp. 37, 41, 43—44.)

This is a far greater admission than the vitalist can desire, — since, if the development and growth of the germ depend immediately upon Almighty Power, so must all the analogous processes of the living being at all stages of its existence. But, whilst this doctrine is utterly exclusive of all the assumed chemical agencies at all periods of life, and overlooks the analogy between the development of the germ and the subsequent processes, there can be no hesitation as to the disposition which should be made of it, without any reference to its prevaricating nature.

It will now be interesting to know the details of this work of development and growth, which is thus allowed, on all hands, to be conducted by powers utterly distinct from the chemical and physical, and in which these have no agency.

"The development of the separate parts," says Müller, "out of the simple mass is observable in the incubated egg. All the parts of the egg, except the germinal membrane, are destined for the nutrition of the germ. The simple germinal disk is the potential whole of the future animal, endowed with the essential and specific force, or principle of the future being, and this germ expands to form the germinal membrane, which grows so as to surround the yolk; and by *transformation* of this germ, the organs of the future animal are produced. The rudiments merely of the nervous and vascular systems, and of the intestinal canal, are first formed; and from these rudiments the *details* of the organization are afterwards more fully developed; so that the *first* trace of the central parts of the nervous system must be regarded neither as brain nor as spinal marrow, but as still the *potential* whole of the central parts of the nervous system. In the same manner the different parts of the heart are seen to be developed from a uniform tube; and the first trace of the intestinal tube is *more* than the mere intestinal tube; it is the *potential* whole, — the representative of the entire digestive apparatus; for, as Baer first discovered, liver, salivary glands, and pancreas, are, in the farther progress of the vegetative process, really developed from that which appears to be merely the rudiment of the intestinal canal. It can be no longer doubted that the germ is *not* the

miniature of the future being, with all its organs, as Bonnet and Haller believed, but is merely *potentially* this being, with the *specific vital force* of which it is endowed, and which it *becomes actually* by development, and by the production of the organs essential to the active state of the *actual* being. For the germ itself is formed merely of amorphous matter, and a high magnifying power is not necessary to distinguish the first rudiments of the separate organs, which, from their first appearance, are distinct and very large, but simple. So, that the later complicated state of a particular organ can be seen to arise by transformation from its simple rudiment. These remarks are now no longer mere opinions, but facts; and nothing is more distinct than the development of glands from the intestinal tube, and of the intestinal tube itself from a portion of the germinal membrane." (MULLER, *ibid.*, p. 23.)

Such, then, is the history of the development of the germ in birds, and in all the higher animals; and the whole work is ascribed by physiologists of every denomination exclusively to principles unknown in the inorganic world, and wholly distinct from any of a chemical nature. They are called, indiscriminately, vital properties, vital powers, vital principle, organic force, creative force, &c., terms, as we have just seen, employed either by Professor Müller or Drs. Roget or Carpenter, to distinguish the principle, or properties from every thing that has any known existence in inorganic substances, or as the source of any inorganic results. But, physiologists of the chemical school stop here, and ascribe all organic compounds after the being is fully formed to chemical agencies. It is remarkable, however, that it has not occurred to these philosophers, that precisely the same elementary combinations, the same formation into tissues, and the same secretions take place at all stages of the elementary development as at all future periods of life, and that the rudimentary development consists in those formations of simple compounds and their union into tissues; and if the early or rudimentary growth of the being, all its secreted products, all its elementary combinations, be determined by the vital properties, so are the *same* results determined by the same properties or powers forever afterwards. To call in the agency of chemical or physical forces, to accomplish *precisely* the same results at any future stage of the organic being as are admitted to be performed in the development of the "essential parts" of that being by the vital principle or vital properties alone, is not only a violation of the plainest rule in philosophy, but of the clearest facts.

We have thus before us a peculiar order of powers by which

the organic being is developed, fashioned, and forever exclusively governed. It is these powers, about which physiology, pathology, and therapeutics, are essentially concerned. We may, therefore, seek in the composition of organic beings, and in the laws of their development, for the whole rudimentary principles of medicine. The vital principle has also the extraordinary task of laying out, in the ovum, the whole organization of the future being, — so that its subsequent labour must be comparatively simple; and it is then, least of all, that it can require any help from the forces of the inorganic kingdom, or that it would permit a violation of the great principle in nature, of avoiding an unnecessary multiplication of causes.

It may be farther shown, by the incipient development of the ovum, that the vital powers, or properties, are more concerned in the growth, nutrition, and all the subsequent physical results, throughout the whole existence of the being, than is generally supposed by even the exclusive vitalists. The usual supposition is that the vessels or instruments of action, which are moved by the vital powers, perform the work of decomposing the blood and other parts, and recombining them again in other proportions and forms, according to the particular organization of parts, and the modification of their vital states. (1) But according to all physiologists, the ovum, in its germinating part, is a mere organic fluid, destitute of vessels, and all other physical parts of the future apparatus.

“That the form,” says Müller, “of the organic matter does not determine originally the mode of its action is proved indisputably by the fact, that the matter from which all animal forms are produced is at first almost without form.” “The germ is a round disk of simple animal matter,” &c.

The first “assimilation of new matter,” therefore, must take place without the agency of vessels, or any of the parts which are subsequently formed; and, therefore, the same powers which converted the fluid germ into vessels, nerves, &c., continue to

(1) It is affirmed, however, by a very eminent chemical physiologist that, —

“The most determined skeptic cannot assert that there is any necessary relation, or, indeed, any relation whatever between the mechanical arrangements and the chemical properties to which they administer. There is no reason why the chemical changes of organization should result from the mechanical arrangements, by which they are accomplished [!] neither is there the slightest reason why the mechanical arrangements, in the formation of organized beings, should lead to the chemical changes of which they are the instruments”! — (Dr. Prout. *Bridgewater Treatise*, ch. 4.) Such is the proof which chemistry offers.

make the same conversions out of blood ; and as all this was originally done without the aid of vessels, so must the same process be forever carried on without their *direct* agency. Nothing in mathematics can be more certain, and nothing, therefore, is more incontrovertible. (*See the last note.*)

By the same rule it may be at once shown that the only ingenious chemical hypothesis ever invented to interpret organic results, — the *catalytic*, — is purely an assumption ; since this hypothesis is predicated of the blood vessels. But, there being no vessels in the germ, the first vessels must, of course, be produced without the supposed chemical influence of vessels, and by my showing, therefore, as to the subsequent formation of vessels and other parts, the supposed agency of catalytic forces is a mere assumption. (*See Med. and Phys. Commen.*, vol 1, p. 74—76.)

By thus reducing this question, which is apparently surrounded with difficulties after the animal acquires its complex structure, to its simple elements, the obscurities disappear ; since what is true of the development of the germ must be equally true of the *same* processes and results in after life.

The question then arises as to what is the particular office of those vessels where the elementary combinations and decompositions take place ? Simply this, to convey, and eliminate through the agencies of the vital properties, those parts from the blood out of which the vital properties effect the new elementary combinations, whether solid or fluid, — to aid in arranging the new molecules, — or to carry forward those fluid products which may be destined for other ends.

But have not the nerves an indispensable agency in effecting the elementary combinations and decompositions ? Certainly not, for the reasons which I have now stated in relation to the vessels ; and this induction concurs with all other facts, and overthrows the hypothesis that the nerves are conductors of galvanism, and, therefore, the supposed agency of this fluid in the processes of life.

But all the vessels, and all the solid parts of the organism, have their various specific offices. Here, in every part, reside the vital properties, which had been fully developed in the ovum, and here are they modified according to the exact nature of the organization and the peculiar final causes of “the properties of the vital principle” in each part. Hence they manifest

peculiarities in parts that are nearly analogous. The modifications vary, for instance, in the serous membranes, and more remarkably in the mucous, as known by the influence of foreign agents, their phenomena, their products, &c. The vital properties differ in different parts of one and the same continuous tissue, as in the mucous membrane of the nose, of the stomach, and of the intestines. Hence, one of the important objects of studying the structure of organs, and the nature of their tissues; for as the vital properties are naturally modified in different parts, so will their alterations in the same disease be different in different tissues of one organ, and for the same reason, even in different parts of one continuous tissue, as in the alimentary mucous membrane, where inflammation of the nose, of the stomach, and of the intestines, is distinguished by almost as striking peculiarities in the vital signs as are the physiological functions of the different organs.

These natural modifications of the vital properties in different parts have, at least, three great final causes. The first is what I have already stated, namely, to separate from the blood, through the agency of the capillary vessels, that exact part which is to be decomposed at any given point; the second is, by these modifications, to enable the "properties of the vital principle" to decompose and recombine the elements according to the exact nature of the combinations which belong to the part; and the third, to qualify the properties, through the medium of the capillary vessels, to shape and unite the new molecules to the old. It is easy to apply this principle, under its different aspects, to all other vessels, as the veins, the secretory and excretory vessels of the glands, and the absorbents.

At the first start of the development of the germ, "the properties of the vital principle" are not aided by any of the foregoing physical means, though they come into operation at the moment they are successively produced. "The properties of the vital principle," therefore, must exist in that organic fluid, in a modification, and with a formative energy which they do not possess in any of the new developments.

There are some branches of physiology of which chemistry has taken more complete and unresisted possession than of others, and the entire philosophy of digestion is almost by common consent consigned to the laboratory. Having, on former occasions, endeavoured to expose this perversion of nature, I will

here add an illustration of the vital character of digestion by regarding that phenomenon in connexion with the principles now before us.

The apparent difficulty with the chemist, (who lives, of course, in great practical ignorance of organic nature, and biased by his pursuits in the inorganic world, or as dead organic matter may come under the influence of fire and acids,)—the apparent difficulty, I say, with the chemist has been in conceiving how such a fluid as the gastric juice should possess life enough to effect the transformation of all sorts of food into chyme, or how this remarkable process should be accomplished by any other power than such as he is accustomed to witness in the remotely analogous results of chemical affinities; and yet he meets the stubborn fact that, in all animals, whatever the nature and variety of food, the chyme is the same compound in all; one unvarying homogeneous substance throughout. (*See Digestion, in Comm. vol. 2, p. 78—122.*)

But it is only my present purpose to say, that we have in the development of the ovum all the necessary elements to interpret the philosophy of vital digestion by the gastric juice. This is in all fundamental respects analogous to the physiology of the impregnated fluid ovum, with the specific difference, that the elementary combinations and the modified properties of the germ are adapted to the creation of a new being out of itself and the blood which is transmitted to it by the viviparous parent; whilst those of the gastric juice are constituted for preparing or “assimilating new matter” for the ultimate growth and repair of that being. We may notice, therefore, the following points of analogy.

1st. The germ is an organic fluid, and so is the gastric juice.

2d. The germ possesses “a creative force” by which new matter from without is assimilated. Here the analogy is very remarkable, since the gastric juice in bestowing the first vitalizing act upon dead matter must also be peculiarly “creative.” In adopting this expressive term, however, from Müller, I would say that both that philosopher and myself employ it in a purely physiological sense, as implying a power impressed by the Creator upon organic beings of perpetuating individuals exactly similar to such as were originally the direct work of Omnipotence; but utterly reject the atheistical doctrine of spontaneous generation, and its kindred one which supposes that animals of superior organization may produce an inferior order. (*See Spontaneous Generation, in Comm. vol. 2. p. 130, &c.*)

The germ in all animals, so far as known, "is a round disk of simple matter, having no difference of form corresponding to the difference of animals." (*Müller, p. 26.*)

Nature, however, has in contemplation the elaboration, out of this germ, of various fabrics; but all upon a common plan in respect to organic life. She has therefore constituted the sensible conditions of the germ in a manner so nearly alike in all, that its differences in different species, in its elementary combinations, and in its sensible form, cannot be detected.

Just so in respect to the gastric juice. It is destined to convert all kinds of food, in all animals, into one homogeneous substance, apparently alike in all, because the elementary combinations of all animals are nearly alike. The gastric juice, therefore, like the germ, appears to be the same to the chemist in all animals; as does also the chyme.

And now what says our great organic chemist as to the agency of a *vital principle* in the most essential part of digestion?

"The equilibrium," he says, "in the chemical attractions of the constituents of the food is *disturbed* by the VITAL PRINCIPLE, as we know it may be by many other causes. But the *union of its elements*, so as to produce *new combinations and forms*, indicates the presence of a *peculiar mode of attraction*, and the *existence of a power distinct from all other powers of nature*, namely, A VITAL PRINCIPLE." (*LIEBIG. Organic Chemistry in its applications to Agriculture and Physiology, p. 357. 1841.*)

The process of generation presents a varied and most impressive illustration of the peculiarities of the vital properties, and of the manner in which they are liable to be impressed and permanently modified in their nature. It results in the production of organic beings similar to those which exercise the generative faculty. This faculty is therefore manifested with as many specific modifications as there are different species of organic beings. If we allow to the globe one million of distinct species of animals, the specific modifications of the germinal product will be as numerous, and these are more or less influenced by the semen of the male. The seminal or productive principle of the male exerts its special influences upon the living properties of the germ, and *directs* their operation in such a manner that none but beings of the same kind with the parents are produced. That the various modifications which distinguish each species are determined by both parents is fully demonstrable in hybrid animals, and is sufficiently obvious in the transmission of the peculiari-

ties of the male, where the individuals are of the same species. And notwithstanding our supposed million of distinct species of animals, and the specific variations in all the parts of each species, (which varieties in animals and plants may be safely estimated at fifty millions,) this almost endless variety is made up by successive depositions of elementary compounds out of mainly four simple substances, namely, oxygen, hydrogen, nitrogen, and carbon, three of which are gaseous, united in modes unknown to chemistry, and which chemistry cannot detect, and forever uniting in different modes and proportions according to the exact nature of every part. The act of generation establishes the modifications which are to be continued, without variation, through the life of the new being; and this new individual, becoming in its turn the agent of procreation, perpetuates all the specific modifications which appertain to itself and to its ancestors. The intermingling of species, which results in hybrid animals, proceeds upon the same plan. It must therefore necessarily be, that the vital properties of the ovum are so impressed by the exciting properties of the semen, that those peculiar elementary combinations and aggregations are started which ultimately make up the hybrid. "These vital properties," says Dr. Carpenter, "confer upon it the *means* of itself assimilating, and thereby *organizing*, and *endowing* with *vitality*, the materials of the inorganic world,"—leaving it, also, clear to all minds that the action of the semen must be exerted directly upon the vital properties of the ovum.

That this important question as to the direct action of the semen upon the vital properties of the ovum, and its capability of establishing certain modifications of these properties, and that the humoral interpretation of transmitted peculiarities is an unfounded assumption, may be definitively settled, I will also add

"The well-known fact, that when the Earl of Morton's Arabian mare was covered by the quagga, not only did the mule so begotten partake of the characters of the sire, but when the mare was subsequently submitted to an Arabian stallion, by whom she had three foals at different times, the first two continued to exhibit some of the distinctive peculiarities of the quagga conjoined with the characters of the Arabian breed."—(MONTGOMERY, *on the Signs and Symptoms of Pregnancy*, p. 17. London, 1837.)

The profound writer whom I have thus quoted, goes on to state the true philosophy of this phenomenon, in supposing that the semen "may influence several ova and so continue to manifest

its effect in the offspring of subsequent conceptions when impregnation has been effected" by males of another species.

The semen, then, is a vital stimulus, and so far on a par with the ordinary stimuli of life. These may be natural, like air, heat, food, &c. ; or they may be morbid, like malaria, poisons, &c. ; or curative, like medicines. In all the cases, their action is upon the vital properties ; and it is in consequence of these influences, that the ovum is developed, that life is maintained, health preserved or impaired, or disease removed. The ova of oviparous animals show the analogy in respect to stimuli, and the principles involved, more impressively than those of viviparous ; since by an admirable design, in respect to the former, the impression of the semen has a limited operation, when the vital properties of the ovum return to their quiescent state, but may be again roused into action by the simple stimulus of heat. (*See Comm. vol. 1. p. 21, &c.*)

The action of the semen upon the properties of the vital principle of the germ is a type of all the influences that are produced upon the same vital properties during the life of the animal, and from which all its organic actions, and all their results, arise. This is the whole essential philosophy of physiology. It is the alterations produced in the vital properties which constitutes the philosophy of disease, and in which, indeed, all disease virtually consists. It is the art of finding out the remote causes, and the nature of the alterations they produce, and of adapting to the altered condition of the properties of life such agents as shall establish new impressions upon them, and thus enable them to return to their natural state, which forms the basis of therapeutics in its connexion with pathology.

Let us now see if the beginning of individual existence does not supply a key to the whole philosophy of disease, as it does to that of physiology. We have seen that all the actions, and all the results of life, are merely effects which arise from the operation of the vital properties through their organic instruments, as bloodvessels, &c. Those properties must be constantly excited into action by foreign agents, as by food, blood, &c., or the properties will become extinct, and of course, the effects will cease. Now, the actions in disease are nothing more than the altered actions of health, and the same rule applies to all the morbid products. It follows, therefore, that the properties of life, upon which these altered conditions depend, are modified or

altered in a corresponding manner. As a consequence of this, it also results that the vital properties have been varied from their natural state by agents or causes capable of producing the change. These agents make their impressions in the same way as the natural stimuli of life, only the morbid agents at the same time affect the nature of the vital properties, and bring them into a new condition. This new condition constitutes disease.

The type of all this may be found in the impregnated ovum. The properties which animate the germ *before* conception are entirely determined by the vital constitution of the female parent. But we have seen that the new being may partake of the physical characters of the male as well as of the female, and it not unfrequently happens that the characteristics of the male are predominant. Hence it follows that the semen so far establishes changes in the original constitution of the vital properties of the germ.

Since, therefore, all the fœtal developments, and all their physical peculiarities, depend upon the precise modifications and actions of the vital properties, and since these properties in the unimpregnated ovum are entirely determined by the female parent, their nature after impregnation must be more or less affected, and assimilated to the peculiar nature of the male parent in all the cases where the offspring manifest any of the male characteristics. This is entirely analogous, in principle, to the modifications which are produced in the properties of life by morbid causes, but with this difference in contingencies. In the case of the impregnated ovum, the modifications are permanently established, and can never be altered, so far as the vital properties, in either parent, upon which the modifications depend, are fundamental in their nature. In the case of the morbid agent, or the cause of disease, the vital properties are diverted from the healthy state, and from *such* modified conditions they commonly possess the ability of escape, and of returning again to their natural standard. In the case of the impregnated ovum, a modifying agent operates, whose properties are intended to confer on the new being a stable condition, however they may modify the exact constitution of the impregnated germ. This vital stimulus, the semen, therefore, in virtue of its specific properties bestows upon the corresponding vital properties of the ovum the peculiarities which belong to itself; and these being natural, vital, and determinate, the transmitted peculiarities should be

equally so. In the case of disease, however, the morbid agents have none of the properties of life which are natural to the fecundating semen, and the modifications, therefore, which they may determine may be different, even if we suppose them to act, as in the case of the germ, upon the whole constitution. Whatever modifications, therefore, may arise from their action, they must consist of deviations from the standard of health. But it does not necessarily follow that certain artificial modifications may not be as permanent as the natural ones; and, it is from observation alone, that we learn that they are so.

In the case, however, of the formation of new "temperaments" by change of climate, and the more remarkable alterations which are produced in animals by domestication, the results are brought about by the new and habitual influences to which the properties of life are exposed; and, in all these cases a radical and permanent modification is established, closely approximating the modifications which are bestowed upon the germ by the fecundating semen. Now, it is also true, that what is denominated predisposition to disease is entirely analogous, in principle, to the permanent temperaments of which I have just spoken. Both are results of physical agents, modifying the properties of life; and this chain of analysis conducts us to those predispositions to disease which are impressed upon the germ by the fecundating semen, and by which we show that the philosophy of the operation of morbid causes is variously, and even exactly exhibited in the impregnation of the germ.

Take the scrofulous subject as supplying an example of hereditary predisposition to disease. If it exist in the female, her ova will partake of this peculiar modification of the vital properties, and it is in this way that her progeny inherits the scrofulous diathesis. Here, then, we see illustrated in the very ovum, even before impregnation, the whole principle which concerns artificial temperaments, and those influences of morbid agents which establish predispositions to disease in the full grown subject. It frequently happens, also, that this natural diathesis is so great, that it results in actual disease before the birth of the offspring, *as manifested by tuberculous affections in the lungs of still born infants.*

But to make the philosophy of this subject more obvious, let us consider the germ when it derives its scrofulous disposition from the male parent. Before impregnation, its vital condition

is perfectly natural. The semen of the male parent establishes upon it the modification which constitutes the predisposition to scrofula, just as malaria determine those modifications which result in fever, &c.

The subject may be pursued under a variety of aspects, and with various illustrations, whether physiologically, or pathologically. The same principle is concerned throughout, whether in respect to the physiological conditions impressed upon the ovum by the seminal fluid, or as these conditions are modified in hereditary scrofula, gout, &c., or whether it concern the temperaments and other permanent changes that are induced by climate, domestication, &c., or, as malaria may establish their peculiar modifications of the properties of life. Nor can such conclusions be unexpected to those who duly consider the simplicity of nature in her elementary principles and laws.

Could the doctrine entertained by Walker, Elliotson, and others, that the imagination of the parents influences the physical organization of the offspring, the philosophy which I have set forth, though not rendered more clear, would be yet fortified. But, that is at best but speculation. I could, however, turn to the mysterious production of the soul. This remarkable principle is doubtless developed at the very outset of fœtal life, from the circumstance of its often combining the intellectual peculiarities of both parents, or again of manifesting chiefly those of the male. But here we have no other fact to guide us, and all beyond has been involved in an impenetrable mystery by the great Creator. Here it is a pride and a help of philosophy to rest on faith alone. (*See Commentaries, vol. 1, p. 82—106.*)

CONCLUSIONS DERIVED FROM THE PRESENCE OF NITROGEN
IN ORGANIC COMPOUNDS.

"It is found that no body destitute of nitrogen possesses, when pure, the property of decomposing spontaneously whilst in contact with water."

"Every azotized constituent of the animal or vegetable organism enters spontaneously into putrefaction when exposed to moisture and a high temperature."

"The VITAL PRINCIPLE opposes to the continual action of the atmosphere, moisture, and temperature, upon the organism, a resistance which is, in a certain degree, invincible." LIEBIG. *Organic Chemistry in its Applications to Agriculture and Physiology*, pp. 257, 357. London: 1841.

I shall now present one or two objections to the chemical philosophy of organic life, as they are founded upon facts in chemistry, and as I am desirous of bringing them to the support of what I have advanced, at other times, upon this topic. The views, I believe to be original with myself.

It is abundantly evident that living organic beings are endowed with properties which protect their elementary composition against all those decomposing agencies which are perpetually separating the elements of all mineral compounds. This shows that the properties, by which the elements of living beings are united, are utterly different from such as combine the elements of inorganic compounds. Nevertheless, the living organization is undergoing a systematic change, a perpetual decomposition, surpassing any mutations that are in progress in the surrounding world. These decompositions are, also, of a peculiar nature, governed by established laws, various in different parts of the same individual, yet forever the same in any given part. I shall not stop to show how the old are replaced by new materials, and how the processes go on *pari passu*, and in opposition to all the philosophy which chemistry teaches, but only say that the decompositions must be effected by properties as peculiar to the living compound as are the results; and that these results conspire with the peculiar modes in which the elements are combined in proving the existence of specific properties, which are the common cause of all the harmonious phenomena of living beings.

When, however, the organic being dies, a new order of decomposition begins, eminently of a chemical nature, and in forcible

contrast with that which concerns the vital process of renewal. Organic beings, indeed, contain within themselves a special principle of dissolution. It is incorporated in the very nature of the elements, and in the modes in which they are combined ; being combined in such modes as facilitate their transformations and disunion after the properties of life have lost their sway. The moment these cease, chemical decomposition begins, — confusedly, violently ; and such are the nature and combinations of the elements, that their disruption would go on with no other contribution from surrounding agents than water alone.

This brings me to my principal object in resuming this inquiry, which is to show that besides the modes in which the elements of organic beings are combined, one of the elements contributes vastly to the chemical decompositions which organic bodies undergo as soon as the vital principle becomes extinct.

This element is that anomaly in the inorganic kingdom, NITROGEN GAS, which abounds especially in animals. Liebig says of it, that,—

“There is some peculiarity in the nature of nitrogen, which gives its compounds the power to decompose spontaneously with so much facility,” — as in the processes of fermentation and putrefaction. “Now, nitrogen is known to be the most indifferent of all the elements. It evinces no particular attraction to any one of the simple bodies, and this character it preserves in all its combinations ; a character which explains the cause of its easy separation from the matter with which it is united.” And again, “when those substances are examined which are *most prone* to fermentation and putrefaction, it is found that they are all, *without exception*, bodies which contain nitrogen.” LIEBIG'S *Organic Chemistry applied*, &c., p. 241.

In the inorganic kingdom, nitrogen is mostly confined to the atmosphere, where it probably exists in a state of simple intermixture with oxygen. “All bodies which have an affinity for oxygen abstract it from the atmosphere with as much facility as if the nitrogen were absent altogether ;” and we have striking examples of the disposition of nitrogen to separate from its compounds, “in the easy transposition of atoms in the fulminating silvers, in fulminating mercury, and in all fulminating substances,” whose ready explosion is owing to the presence of nitrogen.

Now the foregoing characters belong to nitrogen only as it exists in inorganic or in dead organic compounds. In living beings, where it abounds, it adheres to its associated elements

with a tenacity which no chemical agent can impair till it destroys the life of the part ; or in other words, till it destroys those vital properties by which the elements were truly united. It is then, however, that the forces of chemistry take possession, and the elements of the part may explode, I had almost said, with the facility of the fulminating compounds.

“There is,” says Liebig, “in the nature and constitution of the (inanimate) compounds of nitrogen, a kind of tension of their component parts, and, a strong disposition to yield to transformations, which effect spontaneously the transposition of their atoms on the instant that water or its elements are brought in contact with them.” In speaking of the fulminating compounds, he remarks that, “all other substances containing nitrogen acquire the same power of decomposition, when the elements of water (oxygen and hydrogen) are brought into play.”—LIEBIG, *ibid.* p. 244.

But, although dead animal compounds readily pass into spontaneous decomposition under slight degrees of moisture, yet composed as they are, in part, of the elements of water, and very largely impregnated with aqueous substances in their living state, neither this water nor any other agent, can disturb the exact combinations.

But when the organic being dies, chemical agencies have their play, and it is then that

“The result of the known transformations of substances containing nitrogen proves,” according to Liebig, “that the water does not merely act as a medium in which motion is permitted to the elements in the act of transposition, but that its influence depends on chemical affinity. When the decomposition of such substances is effected with the assistance of water, the nitrogen is invariably liberated in the form of ammonia.” LIEBIG.

Whilst, therefore, such is the disobedience of nitrogen to all the ordinary restraints of chemical laws, as it exists in mineral compounds or in organic bodies divested of life, that it either struggles to escape, or is readily liberated by slight influences ; yet, on the other hand, although entering largely and universally into organic beings, it is intimately combined in all with other elementary principles, and is restrained in its place by some power which even puts at defiance all those chemical influences that aid its escape from its elaborate combinations after they have lost the living principle. Its escape breaks up, of course, the organic compound. The hydrogen, the oxygen, and all the other elements then start from their places, and ultimately enter into those binary combinations which are peculiar to the

inorganic kingdom. The nitrogen seizes upon the hydrogen, and forms ammonia, which becomes an important source of aliment to the vegetable kingdom. (1.)

But besides this disposition of nitrogen to tear asunder the elements with which it may be combined, the complexity of these elements in organic beings contributes to the disorganizing results after death, and is another principal cause of spontaneous fermentation and putrefaction.

From the foregoing facts, especially from the universality and fixedness of nitrogen in organic beings, I arrive at the conclusion that the elements of their compounds are united by forces as peculiar as the facts which relate to these compounds, and that the forces of chemistry have no agency in combining the elements, or in effecting changes of their combinations during life.

It is certainly remarkable, that nitrogen, which aids so powerfully in breaking up the elementary combinations of organic beings as soon as dead, should be made such an universal and so large an element in the organic kingdoms; and this the more so, when it is considered that nitrogen is utterly excluded from all combinations in the inorganic world. Were it consistent with proper brevity, I would inquire why this is so; but, being so, it evidently forms a strong characteristic distinction between the organic and inorganic kingdoms. We may readily suppose that among its final causes is the promotion of vital decompositions and recombinations, and ultimately of a complete resolution of the elements. And in respect to the inorganic world, had nitrogen been incorporated in its compounds, there would have been no stability among them. They would have been perpetually undergoing decomposition, until finally the whole of the nitrogen would fly off by itself, and nothing of the original compound would remain, and it could never be recombined.

Intimately, and largely combined, therefore, as nitrogen is with other elements in the organic kingdom, it irresistibly fol-

(1) Liebig supposes that vegetables derive nearly all their nitrogen from the ammonia that arises from the decomposition of animal substances. Whence, then, did they obtain their nitrogen after their first creation, and before a supply could have been yielded by the animal kingdom? The nitrogen of the atmosphere was and is appropriated by plants; and this fact evinces their organic action upon substances in their elementary state. — See LIEBIG'S *Organic Chemistry applied to Agriculture and Physiology*, p. 70, &c., London, 1841.

lows that it is there united by forces essentially different from the chemical ; and, when the being dies, we obtain another and opposite demonstration of the fact in its immediate obedience to chemical laws.

However the chemist may usurp the high calling of the physiologist, we shall find him perpetually baffled in his enterprise, and calling upon nature for help. In respect to the principle which maintains in union the elements of dead organic matter, Liebig says, —

“The atoms exist only by the *vis inertia* of their elements. They seem merely to retain *passively* the position and condition in which *they had been placed.*” (LIEBIG, *ibid.* p. 236.)

Of course, then, he must necessarily allow that some other influences than the chemical originally “place the elements in a position and condition which they passively maintain” after those influences shall have ceased. In my “Examination of Reviews,” (p. 16,) I have shown extensively, that Liebig refers not only the actions of organic beings, but their elementary combinations, to what he denominates a “*vital principle,*” and which he considers utterly distinct from the chemical forces. It presides, in his opinion, over the whole organic economy; and he finally adds, that the

“VITAL PRINCIPLE *opposes* to the continual action of the atmosphere, moisture, and temperature, upon the organism, a resistance which is in a certain degree *invincible.*” (LIEBIG.)

I have also quoted this principal organic chemist, in the same work, (p. 63,) on the side of vitalism, as it respects digestion ; and I will add here one quotation more to show how far hypothetical views surrender to the ordeal of nature, when brought to that great test of all philosophy.

“The equilibrium,” says Liebig, “in the chemical attractions of the constituents of food is disturbed by the VITAL PRINCIPLE, as we know it may be by many other causes. But the union of the elements, so as to produce NEW COMBINATIONS *and forms,* indicates the presence of a PECULIAR MODE OF ATTRACTION AND THE EXISTENCE OF A POWER DISTINCT FROM ALL OTHER POWERS OF NATURE, namely, the VITAL PRINCIPLE.” “If the food possessed life, not merely the chemical forces, but *this vitality* would offer resistance to the *vital force* of the organism it nourished.” “The individual organs, such as the *stomach,* cause all the organic substances conveyed to them which are capable of transformation to assume new forms. The stomach *compels* the *elements* of these substances to unite into a compound *fitted* for the formation of blood. But the blood possesses no power of causing transformations. On the con-

trary, its principal character consists in its readily suffering transformations ; and no other matter can be compared in this respect with it." (LIEBIG, *Op. cit.* pp. 356, 357, 346. — See, also, *Article on Digestion, in Med. and Phys. Comm.*, vol. 2, p. 79 ; and my *Examination of Reviews*, p. 62.)

The "vital principle," Liebig, of course, supposes to reside in the gastric juice, as well as in all parts of the organized being, and that digestion itself is performed by it. It is, however, the language of a chemical philosopher of life, who has embarked his fortunes upon a conflict with that very philosophy which he now and then concedes is fundamental in nature.

Vitalism becomes established in all its aspects, even in what has been denominated "transcendental vitalism," when it may be shown that the elements of organic beings are "united by a peculiar mode of attraction, resulting from the existence of a power distinct from all other powers of nature, namely, a vital principle," since the powers and laws which regulate the composition must be at the foundation of all the subsequent results. After having considered extensively, and on various occasions, the proof of the peculiar vital constitution of organic nature, and of its total abstraction from the forces and laws of inorganic matter, I have brought to the aid of my conclusions the powerful concessions of the most eminent men with whom I have had the honour to hold this discussion. It is manifest that such authorities must weigh with nearly the force of demonstration, since their concessions can only flow from convictions that have been obtained in the school of nature. Amongst the most illustrious of the adverse school of philosophers is Liebig, and standing intermediate is the profound and erudite Müller, who, I cannot doubt, will yet be shoulder to shoulder with his eminent cotemporary, Tiedemann. And having thus referred again to this great philosopher, I will not lose the opportunity of obtaining from him an important contribution to the doctrines of vitalism as they relate to the very composition of organic beings, and in which he institutes a broad contrast between the affinities which unite the elements of organic and inorganic substances. Thus :

"Chemical substances," says Müller, "are regulated by the *intrinsic* properties and the elective affinity of the substances uniting to form them. In organic bodies, on the contrary, the power which induces, and maintains, the combination of their elements, does not consist in the *intrinsic properties* of those elements, but in *something else*, which not only *counteracts* those affinities, but effects combinations in *direct opposition* to them, and *conformably* to the laws of its own operation." (MÜLLER. *Elements of Physiology*, p. 4.)

Now this "*something else*" is what we have seen Müller denominates, in the germ, the "creative force," "the vital principle," &c.

I shall conclude this article by a quotation from Tiedemann, which should be kept in view in all chemical analyses of organic substances, and in considering all their spontaneous changes after death ; namely, —

"Even when the life of organic bodies is *extinct*, we should consider the *qualities* which they possess from the time of death to the complete resolution of organization, as results of the vital powers which have been active in them." (TIEDEMANN'S *Physiology*, p. 29.)

N. B. Since "*every azotized* constituent of the animal and vegetable organism enters spontaneously into putrefaction after death," — and considering the other facts as to the intractable nature of *nitrogen* in the hands of the chemist, by what special art, when he *creates* organic compounds, does he "compel" nitrogen (*see statement as to gastric juice*, p. 33) to undergo a change of its natural characteristic, "by which," according to Liebig, "it evinces no particular attraction to any one of the simple bodies," but an absolute repulsion? Will the chemist answer? Dr. Carpenter says that "we cannot yet succeed in producing artificially any organic compound, even of the simplest kind, by directly combining its elements, because we cannot bring them together in their requisite states and proportions;" and he observes that "Dr. Prout justly remarks, that the *agency of vitality* combines them in modes which we cannot imitate." (CARP. *Princip.* p. 146.)

I say nothing of the pretended creation of *animals* in the laboratory; but refer merely to the assumption, as set forth by Liebig, that, "*by chemical agency we can produce the constituents of muscular fibre, skin, and hair*"! (LIEBIG, *ibid.* p. 354. See, also, particularly my *Examination of Reviews*, p. 40.)

Let us, therefore, weigh well the "facts" which may be contributed by organic chemistry.

ON THE MODUS OPERANDI

OF

REMEDIAL AGENTS.

“THE VITAL FORCE appears to be affected *primarily* by a great many poisons, by the vegetable or animal emanations, known by the name of miasmata, and by various modifications of the external agents which are incessantly acting upon us, as want of due exposure to the sun, too damp an atmosphere, and an unwholesome diet.” — ANDRAL. *Pathological Anatomy*, vol. i, p. 423.

“It seems to me that the explanation which represents Nature always pursuing a uniform course in her operations, drawing the same results from the same principles, has a greater degree of probability than that which shows her separating, as it were, this phenomenon from all the others, in the way which she produces it.” — BICHAT. *Gen. Anat. &c.*, vol. ii, p. 54.

IT is the object of this Essay to inquire into the modus operandi of remedial agents.

In the first place I hold, in conformity with the proof which I have set forth in the Medical and Physiological Commentaries, that the vital principle is a real substantive agent, of which the vital properties, (irritability, mobility, &c.,) are elements, superadded to organic beings after the creation of their structure; and that the nervous power was especially superadded to man and animals, as were also the soul and principle of instinct. In what way the nervous power, the soul, and the principle of instinct, are related to the vital principle, of which the organic properties are the elements, (or as Müller has it, “*properties of the vital principle;*”) we know not; but as an intimate relation does exist, it is not unbecoming human reason to attempt some knowledge of its connexion. (*See Med. and Phys. Com. vol. 1., p. 82—93.*) I also now assume, what I have endeavoured to prove in the same work, as well as in the foregoing essays, that all organic actions are carried on by the vital properties through the medium of their instruments of action, — that all vital stimuli, whether natural, morbid, or remedial, operate directly upon those properties, (or, if it be preferred, the agent makes its im-

pressions upon the instruments of action through the medium of the vital properties,) that all disease consists, essentially, in a modification of those properties and a consequent change of function, and, finally, in the language of Bichat, —

“It is undeniable that all remedies have for their object the restoration of the *vital forces* to the natural type, from which they have been driven by disease. Since the morbid phenomena may be considered as different *alterations of these forces*, (1) the action of remedies should also be viewed as the means by which these alterations are to be brought back to their natural type.” BICHAT. *General Anatomy applied to Physiology and Medicine*, vol. i, p. 19.

I also say, with that illustrious philosopher, that if you

“Examine all the physiological and all the pathological phenomena, you will see that there is no one which cannot be ultimately referred to some one of the vital properties of which I have just spoken.” BICHAT, *ibid.*, p. 17.

In which sentiments Andral concurs :

“In *every* disease,” he says, “not immediately produced by external violence, the symptoms that occur depend either on a *lesion* of the (*vital forces*) (1) that *animate* every living part, or, on a lesion of organization. The former is *primary* and *constant*; the latter is *secondary*, variable in its nature, and *inconstant* in its existence. ANDRAL. *Patholog. Anat.* vol. i, p. 422.

I farther believe, that I have shown sufficiently, in the Medical and Physiological Commentaries, what I have affirmed in my *Materia Medica*, namely, that

“The partial absorption of certain remedies is only a contingent result, and has little or no agency in the physiological phenomena. Their reputed absorption is greatly overrated, often only imaginary, and sometimes misrepresented. Such as have no natural relation to the vital properties modify the natural condition of the absorbing vessels before they can enter the circulation.”

Whatever is true of remedial agents, in this respect, is equally so of morbidic, as I have also specifically set forth; whilst the whole philosophy of their operation rests upon physiological principles. The effects of physical causes are exactly on a par with those of a moral nature; and the cathartic which purges, the emetic which vomits, the narcotic which induces sleep, or each, and all, when they destroy, produce their effects upon exactly the same principles as the warmth which instantly

(1) See a remarkable misrepresentation as to the word *FORCE*, by Dr. Carpenter, in my “Examination of Reviews,” p. 7, &c. Also, preceding pp. 14, 36.

rouses all the processes of life when applied to the surface in certain morbid conditions, or as offensive spectacles and odours lead to instant vomiting and purging, or to syncope, or to a paroxysm of fever; or, again, as an hour's change from one part of the town to another suspends pertussis, or as one passion cures the most obstinate maladies, or as another is instantly fatal.

The fundamental philosophy of disease is perfectly simple, as is also that which concerns its cure. Disease is essentially nothing more than a deviation of the properties of life from their natural standard, and a consequent corresponding change of functions over which the affected properties preside. The artificial cure consists in a restoration of those properties and functions by making upon the former certain impressions which enables them to obey their natural tendency to a state of health; for it should be observed that no remedies are capable of transmuting diseased into healthy conditions. That is the work of nature. Most of our medicines may, also, operate as morbid agents, and even such remedies as are not directly of this nature, exert their influences upon the same principle. The former operate, by establishing, in a direct manner, certain morbid alterations in the already diseased properties and actions of life, which are more conducive to the natural tendency that exists in the vital properties to return from morbid to their natural states. The latter also exert effects which are analogous, since these, in like manner, do but lead to changes in the diseased conditions which enable them to take on the recuperative process.

The *vis medicatrix naturæ*, therefore, consists in an inherent tendency in the properties of life to maintain their state of integrity, or to return from those altered conditions which constitute disease to their natural state, or a state of health. When, therefore, disease subsides under the influence of remedial agents, it is only in consequence of that great law, which is brought into sensible operation by the production of morbid states which are favourable to its development; but if disease terminate fatally, it is owing either to morbid alterations which transcend the recuperative tendency, or to physical obstacles which have resulted from the altered vital conditions. If disease subside spontaneously, it arises from the operation alone of that natural principle which has been established for the preservation of

health, and the perpetuation of organic beings. Of this we have remarkable and striking examples in smallpox, measles, &c.

But, for wise purposes, a principle of mutability has been also established in the properties of life, by which they may be variously altered from their natural state by physical and moral causes; but it is this very principle which enables them to receive salutary impressions from remedial agents, (just as they do from morbid,) and to return to their natural condition.

The changes to which the properties of life are liable, are almost of endless variety; depending upon the nature of the morbid causes, habits, natural and artificial temperaments, age, sex, &c.; and whenever they become diseased, they pass through many progressive changes till they reach the acme of their morbid states. And so, on the other hand, when remedial agents begin their operation, a series of other changes set in, and continue in regular progress until they end in health. The pathological conditions, therefore, of any given disease are constantly varying, and may require frequent variations of treatment; though it commonly happens that the shades of difference are too slight for any essential change of remedies till the pathological changes shall have passed through a considerable series.

This leads me to consider, next, the application of a foregoing principle to the treatment of disease. It being only necessary to establish a peculiar morbid change in diseased conditions that shall favour the operation of the natural tendency of the properties and actions of life to return to their healthy state, a very few remedial agents may be all that are requisite to the attainment of that result; whilst experience shows that our *materia medica* is encumbered with superfluities. Take a large variety of pathological conditions, such, for example, as are presented by inflammation, it is not necessary that a certain uniform change should be established by the remedies, but only such as shall favour the recuperative tendency. Bloodletting brings about one kind of change, cathartics another, antimony another, mercury another, and so on; whilst each of these agents may prove perfectly curative in many cases of all the modifications to which inflammation is liable from absolute morbid agents. And yet it is obvious that each one produces changes peculiar to itself, whilst the changes induced by either will be as various as the natural modifications of disease. And just so it is in respect to the great variety of remedies which will tend to the cure

of intermittent fever. This disease will sometimes yield to almost every thing in the materia medica, and may be suddenly broken up by an emotion of the mind. But every agent exerts changes in the morbid properties of life peculiar to itself, but such changes as enable the properties and actions of life to pass, afterwards, through a succession of spontaneous changes under the restorative principle, till they end in health. There is no other philosophy that will account for any of these phenomena, whilst they all concur in demonstrating its foundation in nature. Hence, also, I may add, what I endeavoured to expound in the "Commentaries," the occasional salutary effects of alcoholic stimulants in the treatment of fever, and acute inflammations, and through which, in part, I attempted to abolish the distinction between active and passive inflammation. (*Com. vol. 2, p. 524—546.*) In these examples, the alcoholic stimulants do but introduce morbid conditions that are favourable to the recuperative process, and are, therefore, so far on a par with loss of blood. Nevertheless, a distinction is very properly made into curative and morbid agents, however the former may be productive of disease, as they commonly are, in their medicinal doses when they do not correspond with the existing pathological conditions. Their absolute mode of action, however, is the same in all the cases; and although, in a general sense, remedial agents exert their salutary effects by inducing new pathological states, and are generally liable to produce disease when exhibited in health, these morbid states, when not excessive, are of a nature to allow the full exercise of the recuperative tendency. On the contrary, however, there is a class of agents which are more profoundly morbid, and whose results transcend the natural recuperative process. It is for the removal of these consequences that we employ the other class of morbid agents. Or, there are yet other means, like exercise, air, &c., whose influences are of the mildest alterative nature, and appear to cooperate in a direct manner with a tendency to restoration which had already begun; or, as in whooping cough, where the restorative process is often easily introduced. Our remedies, therefore, are curative by substituting new pathological conditions, and nature does the rest; and it is only with a view to a right interpretation of their *modus medendi* that I have any disposition to depart from established phraseology, or to confound the operation of remedies with that of the ordinary causes of disease.

I now proceed to a statement of the manner in which remedial agents produce their effects upon parts remotely situated from the direct seat of their application ; and this, as I have formerly said, is through remote, continuous, or contiguous sympathy ; the agents exerting their direct impression upon the parts with which they are in contact. Remote, and, probably also contiguous sympathy, are conducted by the nervous power through the medium of the cerebro-spinal and ganglionic systems ; whilst, as I have endeavoured to show in the "Commentaries," continuous sympathy is more or less independent of the nerves. When, however, these enter into the structure of parts, as in animals, they have a certain contingent participation. But their primary connexions may be wholly severed, and disease may be yet propagated continuously along the part to which they appertained ; as we observe also in plants. It appears, therefore, that in these examples, the morbid condition is extended, in a continuous manner, from the organic properties of one point to the next in apposition. It is now my purpose to enlarge upon the philosophy of remote and contiguous sympathy, as was represented in the "Commentaries," and in my "Introductory Discourse."

I shall not go into any farther proof relative to the existence of the vital properties as contradistinguished from the properties of inorganic beings, nor of the nervous power. These I assume to be already established, and that they are distinct from each other ; and I farther assume that the nervous power is capable of acting as a vital stimulus to the organic properties, is liable to be variously developed by morbid and remedial agents, and to be so modified in its nature according to the virtues of such agents, that it produces, more or less, in diseased parts, remote from the direct seat of the morbid or remedial action, the changes which the agents themselves would exert were they applied directly to the remote organs. (1) The type of all this exists in various processes which are naturally going forward in the animal body, and as profoundly illustrated by the experiments of Sir Charles Bell, Marshall Hall, Wilson Philip, Prochaska, Whytt, Reid, Valentin, and, lastly, as set forth in a masterly manner by Professor Müller in his *Elements of Physiology*. The nervous power is superadded to animals, for the purposes of voluntary motion, as a regulator of their complex organization, and as an

(1) The whole of this doctrine is briefly laid down in the *Medical and Physiological Commentaries*, vol. 1. p. 570—572.

auxiliary to the organic properties ; operating as a stimulus to those properties, by which all actions are virtually performed.

The brain and spinal cord are the great centre of the nervous power, (in the entire state of the animal,) and the nerves of animal and organic life, especially the latter, are the media by which the impressions of morbid or remedial agents are transmitted to the great centre, and through which the nervous power is radiated abroad upon all parts of the organism. The nervous power may be, also, equally determined with a morbid or curative effect upon the organic properties and actions of the great nervous centre ; or upon any of its radiating parts. The philosophy is also exactly the same when one diseased part gives rise to disease in parts that are remote ; and when disease in remote parts, that has been maintained by affections of other parts, subsides in consequence of the restoration of the latter, it is owing to the removal of a pernicious modification of the nervous power that had been constantly propagated by means of the latter upon the former.

Let us now take a simple physiological example to illustrate our doctrine ; and they who have the disposition to pursue the inquiry should study well the laws of sympathy as laid down by Professor Müller, and the elaborate experiments and inductions of Dr. Hall. Such as are skeptical as to the independence of the organic properties of the nervous power, should study Haller, and the great work of Wilson Philip on "The Laws of the Vital Functions." To these works I would also respectfully call the farther attention of some of the present able writers upon the functions of the nervous system, who, as it appears to me, are losing sight of the organic properties, and attributing to the nervous power what belongs to the former.⁽¹⁾ When the

(1) I do not, of course, concur in the following very important conclusions in Dr. Hall's late "Memoir" :—

"The spinal marrow," says Dr. Hall, "exclusive of the cerebrum, is the source of animal life."

Animal life, I apprehend, depends as well upon the organic properties, or vital principle, as organic life. The spinal marrow is a "source" of the nervous power, whilst *sensation*, both in animal and organic life, is related to the brain. If, also, sensation or other cerebral phenomena disappear by interrupting the spinal cord, it hardly follows that the brain and its prolongation may not be mutually concerned in all the phenomena which relate to the nervous system, in their state of integrity. Experiments are here surrounded by so many accidents, that their results must be constantly brought to the test of the natural phenomena, or of such experiments as occur in Philip's "Inquiry into

foregoing authors are comprehended, the foundation of medical philosophy is laid. But for our physiological example.

“The whole system of respiratory nerves,” says Müller, “can be excited to action by irritation of any part of the mucous membrane, from the mouth to the anus, from the nostrils to the lungs.”

the Laws of the Vital Functions.” I distinguish, of course, between *irritability* and *sensibility*. If the former be affected in other parts than the nervous tissue by disease or by injuries of the brain or spinal cord, or by experiments upon them, it is in consequence of a pernicious *nervous influence* which is determined upon that property of organic life. This clearly appears from Dr. Hall’s next following propositions, namely,—

“That the cerebrum is, in its acts of volition, an exhauster of that irritability,—(the irritability of the muscles of organic life:)

“That in muscles separated from their nervous connexion with the brain, we have augmented irritability:

“That in muscles separated from their nervous connexion with the spinal marrow, we have, on the contrary, diminished irritability.”

Here the organic property, *irritability*, is variously modified according to the manner in which it is influenced by injuries done to the nervous connexions. The nervous power, also, may be strongly affected by the simple division of a nerve, as we know by the inflammation it may produce in parts which the nerve supplies,—irritability being thus exalted. (*See the Med. and Phys. Commentaries, vol. 1, p. 474—480.*)—Or it may be, as I have stated in the “Commentaries,” that “when inflammation is excited by dividing a nerve, or by paralysis, the organic forces are directly altered by suddenly withdrawing the nervous influence, as well as by thus deranging the mutual relations between the forces which animate the different tissues of a part; those relations being equally influenced by the nervous power.” (*Comm., vol. 1, p. 572.*) Again,

“The irritability of the muscles of organic life,” says Dr. Hall, “depends probably on the ganglionic system.” (*HALL, on Diseases and Derangements of the Nervous System, p. 222: 1841.*)

On the contrary, I apprehend that *irritability* is everywhere as independent of the nervous system in animals, as it is in vegetables. It is only *influenced* by that system. Nor can it be admitted that “the cerebrum is, in its acts of volition, an exhauster of the irritability of the muscles of organic life.” The irritability of those muscles is always in a state of equilibrium in health, as shown by the unvarying nature of the organic functions. When I speak of the brain and spinal cord as the centre of the nervous power, I refer to the animal in its state of integrity. The ganglionic system may be also a centre of this power, and the power may be developed in the spinal cord and in portions of the nerves when separated from their connexion with the brain, or spinal cord. The phenomena of contiguous sympathy are here important, as well as certain experiments upon isolated parts; though we should bear in mind the difficulty of separating, entirely, any part from its connexions with the brain and spinal cord, unless when wholly abstracted from the body.

It is through this principle that emetics and cathartics produce their most sensible manifestations, and the same is concerned in all their influences upon other parts. It is the same as concerns the process of respiration, which takes place after the following manner. The point of departure is the mucous tissue of the lungs, from which an impression (arising probably from the partial absence of atmospheric air) is transmitted through the pneumogastric nerve, as well as through the ganglionic, to the brain and spinal cord, (especially the medulla oblongata,) where the nervous power is developed and reflected upon the organic properties of the muscles of respiration, through the various motor nerves of those organs. These muscles are, in consequence, thrown into action, and the thorax is thus expanded.

Müller says, "like many other persons, I sneeze whenever the bright light of the sun falls on my eyes." (P. 352.) Here the process is more complex, and shadows forth the far more intricate processes that are going forward, — the almost endless circles of sympathy which are taking place, — during the progress or decline of disease, or those which are set up by the operation of an emetic, a cathartic, &c. In the example before us, the sensation is transmitted to the brain and spinal cord, where the nervous power is developed and reflected upon the schneiderian membrane. Here a new sensation arises which is sent back to the brain and spinal cord, the nervous power again developed, and, according to relations between that membrane and the respiratory organs, the nervous power is now reflected upon the respiratory muscles, when sneezing follows as the result of the convulsive movement. Again, the mind will do the same thing, when dwelling intensely upon a former paroxysm of sneezing. Sympathetic yawning, and sympathetic micturition, are of this nature; the mind being then the stimulus which develops the nervous power.

The examples of sympathetic influences, through the reflex action of the brain and spinal cord, are almost endless, as they also are in every part of the animal organism. They supply the most ample ground for the interpretation of the effects of remedial and morbid agents in their wide range of influences. The modifications of the circles of sympathy which relate to the respiratory system alone, as in coughing, crying, laughing, yawning, &c., are a fruitful field of inquiry into great and pre-

cise laws, and extensively applicable to the philosophy of medicine. The only difference is, that, when disease is established in a part, or when remedial agents operate, the organic properties of the part are altered in their nature, and, of course, the organic actions over which they preside. A specific impression, in the latter cases, is transmitted to the cerebro-spinal axis, and from thence reflected through other nerves upon the organic properties of other parts, and, according to its nature, disease will be produced or mitigated in those parts. However complex and variable, therefore, the phenomena, nothing can be more simple than the principle through which all these changes are produced.

When an emetic operates, the philosophy of its influences is the same as that which relates to respiration, &c. The impression upon the stomach is transmitted to the brain and spinal cord through the pneumogastric and ganglionic nerves, the nervous power developed and reflected in the foregoing manner upon the respiratory nerves, whilst another current descends along other fibres of the pneumogastric to the muscular tissue of the stomach. If the emetic operate, also, as a cathartic, then a new chain of actions is established, in the same way, in the abdominal muscles, whilst a current of the nervous power is propagated upon the muscular coat of the intestines. (1)

(1) Among the sound practical conclusions, and shrewd observations, for which Dr. Holland's *Medical Notes and Reflections* are distinguished, and which reach far into the profound philosophy of life, is the following remark. "A single emetic," he says, "may cut short a paroxysm of asthma for which opiates and antispasmodics have been employed in vain." Dr. Holland has also propounded the essential mode in which the emetic produces relief; and were the same philosophical principles more generally understood, we should less frequently witness abortive attempts to accomplish by "opiates and anti-spasmodics" what may be often "cut short" by an emetic, or again by loss of blood. Thus:—

"I need hardly advert but slightly," says this philosopher, "to the benefit derived from emetics in asthma; though here again it must be admitted that there is an insufficient use of the remedy, seeing the great good gained in many such cases by unloading the stomach and liver; and the *equal advantage*, though less obvious in explanation, from its influence on the actions of the circulation and nervous system." (P. 313.)

A part of the "influence" through the medium of the nervous system, I apprehend to be the following. During the paroxysm, the respiratory muscles are employed in embarrassed acts of respiration; but, as soon as the emetic operates, they are thrown by the nervous power into a new series of convulsive movements, by which the respiratory are brought back to their natural condition. If the stomach be offended by irritating food, &c., its removal alone may take off the main cause of that peculiar development and determination of the nervous power which affects the respiratory

But, in the foregoing case something more happens than in the natural processes. Here the exciting cause possesses peculiar virtues, is of a morbid nature, and it not only makes peculiar impressions upon the alimentary mucous tissue, according to the exact nature of its virtues, but it modifies the nervous power in a corresponding manner. If the stomach be the seat of disease, the direct impression upon that organ, or the change which an emetic may effect in its vital condition, will be more or less varied from what is exerted in a state of health. It may, therefore, prove curative to the stomach by this direct influence. But the nervous power is also modified according to the impression produced upon the organic properties of the stomach, and is sent abroad, with alterative effect, upon various parts of the system. According to a law by which diseased parts are far more susceptible of influences from vital stimuli than such as are not diseased, the modified nervous power will fall with far greater effect upon the former than the latter. The organic properties and actions of one may be profoundly and permanently affected, whilst the latter are only moderately and very temporarily influenced. In consequence, also, of the deep effect which the modified nervous power exerts on the diseased parts, they may return, at once, to their natural state.

But the milder influences which are set up by the nervous power upon parts in health, or in comparative exemption from disease, play, also, their part in the salutary process. If the emetic operate also as a cathartic, impressions are transmitted from the intestinal mucous membrane to the cerebro-spinal system, the nervous power developed and modified according to the nature of these impressions, and radiated abroad as when the result of the action of the emetic upon the stomach, and with effects corresponding to this new development and modification of the nervous power.

Again the skin is influenced in the foregoing manner, and this organ transmits that impression to the cerebro-spinal axis, and develops and modifies the nervous power accordingly, when it is, as in the other instance, reflected abroad, and is felt by various parts according to their degrees of susceptibility. Various muscles, and thus, mostly, the paroxysm may be removed. In other cases, where bloodletting is the remedy, there is a state of venous congestion of the lungs, — perhaps, also, of the liver. The loss of blood then relieves by subduing the morbid state of the veins. (*See Medical and Physiological Commentaries, vol. 2, p. 494—562, where this subject is fully investigated.*)

other circles of sympathy of the same nature set in, and become too complex for analysis; but all may fall with one concurring, curative effect upon the diseased susceptible organs.

We thus see that when vomiting springs from the operation of tartarized antimony, and often from ipecacuanha, it is only one of the consequences, and a minor one, of the peculiar irritation of the gastro-mucous membrane. Other and far more powerful influences are determined, simultaneously, upon the organic properties and actions of distant and diseased parts, (perhaps as distant as the most remote extremity,) by the same nervous power that shook the respiratory organs during the act of vomiting. And often, indeed, does it happen that those influences are propagated with the most profound effect, when the act of vomiting fails of being consummated; and nausea alone shall send with prostrating effect the modified nervous power over the whole system; when we shall see it simultaneously bathing the whole surface with perspiration; pouring the saliva from the mouth; breaking down a tumultuous excitement of the heart and arteries; starting on the instant a torrent of bile, and an equal effusion from the intestinal mucous membrane; and, at the next moment, calling up a magnificent play of sympathies for the evacuation of the fluids, after the manner of an active purgative,—these very effusions, also, instituting other circles of sympathy, which join in the great work of curative movements. Should vomiting now follow, then shall you speedily see the vital energies returning,—the cold pale skin giving place to a florid hue and a warm perspiration,—the sunken features starting into the fulness of health,—the gastric suffering gone as a luxury obtained,—the general whirl of anxiety and distress converted into calm tranquillity,—the headache dissipated,—the twang of the croup, or the grunt of pneumonia, no longer sounding an alarm;—and, all this stupendous succession of events, from the beginning of nausea to the restoration of the vital energies and the near resolution of disease,—composing a most astonishing consecutive series of sympathies,—may require less time than I have hastily employed in this general allusion to the subject. And now can it be entertained, that this has been the result of absorption, or that the laws of chemistry or physics have had any connexion with the phenomena?

The foregoing may be taken as an example of the principle which concerns the *modus operandi* of all curative or morbid agents, whether physical or moral, and of all the developments of disease that arise as sympathetic consequences of each other. In respect to emetics, however, it should be considered that all do not produce the foregoing effects, and that with the exception of the act of vomiting, the results will depend upon the precise nature of the emetic, or the manner in which it modifies the nervous power and thus impresses the organic properties. This explains the difference in results between tartarized antimony, ipecacuanha, sulphate of zinc, warm water, tickling the fauces, the mechanical irritation of undigested food, the shock of a fall, of a surgical operation, sailing, whirling, offensive sights, offensive odours, loss of blood, and even their recollection; whilst the nature and effect of the greater number should lead the philosophical inquirer to pause at the physical doctrine of absorption, and survey the other difficulties with which it is fatally encumbered.

When the alterations, of a sympathetic nature, are more slowly produced, as when mercury gradually induces salivation, and brings the whole system under its influence, or when small, and repeated doses of tartarized antimony overcome inflammations of the lungs, &c., the nervous power is developed and modified at each successive dose, and the repetition of its influence upon the organic properties of diseased parts remote from the stomach establishes progressive changes, till an absolute condition of disease may be induced in certain parts, as when mercury salivates; whilst the analogous influences which are exerted on parts already diseased supplant the naturally morbid states by others of an artificial nature, from which the organic properties are able to return to their healthy condition. But these impressions must be frequently repeated; for if the interval be long between the administration of the doses of such agents as only produce their effects in a gradual manner, the diseased conditions, not being placed in the way of the recuperative tendency, will throw off the artificial impression, and the original intensity of disease will be thus restored. The process which I am now considering is an example of the *cumulative* effect of remedial agents, some of which are much more remarkable than others, and the ultimate results are pronounced with varying degrees of suddenness. This is also influenced by peculiarities

of constitution, or of susceptibilities of the organic properties to changes now under consideration ; and therefore is it, that salivation may be speedily induced in one subject by less than a grain of calomel, whilst no amount of the remedy will produce this effect in others. And so of the morbid effects of digitalis ; an agent, also, which exemplifies the instantaneousness with which alteratives may produce an explosion of disease, although no symptoms had admonished us of its approach. This principle concerns, also, the predisposition to disease which is formed by miasmata, the virus of smallpox, of hydrophobia, &c.

The permanent operation of the nervous power in particular parts of the animal fabric, as in the sphincters, supply an elegant parallel with the foregoing uninterrupted influences of the same power as developed by remedial or morbid agents. This power operates as a perpetual stimulus to the organic properties of the muscles just mentioned, in the same way as blood does to the heart and capillary arteries. And now, if we mutilate the inferior part of the spinal cord, or observe the sphincter ani when relaxed in bad cases of apoplexy, or regard its condition when the spinal cord is merely divided, we shall see the relative bearing upon other organs of these two parts of the nervous system in their connected state, but with injury of the brain, and how the spinal cord is capable of an independent influence. (*See note at page 42.*)

When moral causes operate in the cure, or production of disease, they act directly upon the cerebro-spinal axis, and develop and modify the nervous power according to the nature of each mental affection ; and, as in the case of physical agents, the nervous power thus developed and modified may be determined as well upon the organic properties of the brain and spinal cord, as upon other parts. (*See note, page 42.*) The blow upon the region of the stomach, or the opening of a thecal abscess, which have destroyed life on the instant, operate in the same way as the paroxysms of anger, or of joy, which have been as suddenly fatal. In these cases the nervous power is first determined with a fatal effect upon the organic properties of the nervous centre.

The artificial modifications of the nervous power have analogies in the natural modifications of sensibility, irritability, &c., in different organs and tissues, and in tissues of the same nature ; as the mucous for example. But, there are more striking anal-

ogies in the artificial temperaments, and as the organic properties are affected in the various conditions of disease.

We need not inquire into the nature of the nervous power, or of the organic properties. It would be as absurd as to interrogate the nature of gravitation, or of any other property of mere matter, or even of matter itself; though we may well say what the nervous and organic powers *are not*, and thus save much speculation and its resulting practice. We know enough of the whole, for all the purposes of philosophy, and for the good of mankind, by the phenomena alone; but since the phenomena of organic beings are far more diversified than those which relate to inorganic matter, so, also, should we be as contented with the former as with the latter, and apply them in the same philosophical and practical manner. We also know enough of physics to marvel at nothing in organic beings which may be utterly different from the constitution, the phenomena, and the laws of inorganic matter; and if it seem mysterious that such an agent should exist as the nervous power, with the characteristics which I have here assigned, it will become less wonderful when we reflect upon the phenomena of the immaterial mind in its connexion with organization, as in voluntary motion, blushing, palpitation, syncope, apoplexy, &c., or even upon the velocity of light and the inconceivable rapidity of its undulations; and, above all, that it is not an improbable doctrine, that the light, heat, and deoxydizing property, of the solar beam, reside in a common principle, and are due to modifications of that principle by foreign influences. So, also, in respect to the modified developments of the common agent upon which the phenomena of electricity and galvanism depend.

Having now completed the outline of the doctrines which it was my purpose to set forth in a more connected manner than on former occasions, I shall add a few explanatory remarks.

The impressions which are made in organic life, by vital agents, whether natural, morbid, or remedial, are mostly upon the *irritability*, but partially on *sensibility*. (*See note, p. 42.*) The latter property is the subject of impressions particularly in animal life; though it becomes more or less involved in organic by the accidents of disease. (*See Med. and Phys. Commentaries, vol. 1, p. 474—480, p. 568—572; vol. 2, p. 18—20.*) *Perception* is necessary to *sensation*, and whenever actions take

place independently of sensation through the medium of the nervous power, the impressions are transmitted to the cerebro-spinal axis by the *irritability* of the nerves. In organic life, the reflected nervous power operates, first, upon *irritability*, from which it is imparted to *mobility*, &c., and this is probably also true in animal life; though in the latter case, when sensation arises, the impressions which are transmitted to the brain and spinal cord are through the medium of *sensibility*. In voluntary motion, the mind develops the nervous power and directs it upon the *irritability* of the particular muscles. In all the cases of primary impression, however, where *perception* is excited, *sensibility* is more or less interested. When morbid or remedial agents operate, they modify the *irritability* of the part upon which their direct action is exerted, and in a way peculiar to the virtues of each; which is the cause of the modifications of the nervous power. These, being reflected upon the irritability of diseased parts, modify that, and consecutively the other organic properties, according to the acquired peculiarities of the whole. The principle is the same as it respects the passions and all the mental emotions. Our remedial agents, therefore, will be curative or morbid according to the alterations which they may thus produce. I cannot enter upon the details of facts by which all this is perpetually illustrated. Every mind is adequate to the inquiry. If the brain, or any part of the nervous system, be the seat of disease, of irritation, &c., the preternatural development of the nervous power is *direct*, and exceedingly various in its nature and intensity. It is also liable to remarkable developments and results from the mechanical irritation of remote parts; as when undigested food produces apoplexy, or a blow upon the epigastric region, or a slight surgical operation, is followed by instant death.

The nervous power is not only variously excited, exalted, or depressed, or modified in its kind, and produces influences upon remote parts according to these changes, but it is reflected upon particular parts according to their existing susceptibilities, the nature of the remote cause, and the part upon which the remote cause may operate. Thus one impression from cold, as a blast of cold air, or a drop of cold water upon the skin, will rouse the respiratory muscles. Another impression from the same cause will excite catarrh, or pneumonia, or articular rheumatism. (*See Med. and Phys. Comm. vol. 2, pp. 18, 41—50.*) Mercurial

ointment will determine the nervous power specially upon the salivary glands, and liver, and the same effects arise from the action of mercury upon the stomach. Cantharides, internally or externally applied, irritates the neck of the bladder. One degree of impression by tartarized antimony upon the stomach determines the nervous power upon the respiratory muscles, and vomiting is the consequence; whilst it simultaneously reflects the same power upon the skin, as it does in smaller doses, and of which perspiration is a consequence, — and so on. But these examples embrace only certain parts of the influences in each case; whilst in others, they are far more complex, — one sympathetic result becoming the cause of others, till, through a single impression upon the organic properties of the skin, various circles of morbid or remedial sympathies may be instituted. Narcotics induce peculiar modifications of the nervous power when they are administered by the stomach, and the power thus modified is not only reflected upon various distant parts with effects corresponding with its modifications, but especially, also, upon the organic and animal properties of the brain and spinal cord. Hence the obtuseness of the senses, and the venous congestions of the brain, which follow their improper administration. (*See Med. and Phys. Commentaries, vol. 2, p. 480—488.*)

Notwithstanding, however, the complexity of the results that arise from the sympathetic processes in which the nervous system is concerned, whether excited by healthy, morbid, or remedial agents, they all depend on a common law.

I have but little to add specifically upon the doctrine of the absorption of remedial and morbid substances to what I have extensively set forth in my treatise on the Humoral Pathology. I will, however, state a few objections more, which, like those offered in the Commentaries, will suggest a multitude of others. I may point to one, also, which I have stated in my *Materia Medica*, (p. 180,) relative to the variety of results which follow different quantities of certain preparations of iron, whilst it cannot be said that the slight natural ratio belonging to the blood is increased. The same considerations are equally applicable to a vast number of remedial agents. Wedemeyer and Müller testify to the fatal effect of one drop of the hydrocyanic acid within a single second, when introduced into the eye of a rabbit; whilst Müller allows that from half a minute to two minutes are neces-

sary to the absorption of other substances. Magendie kills "the most vigorous dogs" by applying to the fauces one drop of the hydrocyanic acid, "after two or three hurried inspirations." Pereira says that he "once caused the *instantaneous* death of a rabbit by applying its nose to a receiver filled with the vapour of the pure acid. The animal was killed without the least struggle." And so did Magendie. Pereira adds, that in cases of this nature, "the rapid action of the poisons seems almost incompatible with the idea of their absorption." (*Pereira's Materia Medica*, pp. 27, 242.) Look at the action of opium. Apply it to the mucous tissue of the intestine, the local impression is such that it immediately arrests the peristaltic movements. (*See Med. and Phys. Commentaries*, vol. 1, pp. 477—480, 506—512, 563—576, for many analogous experiments, and for an examination of Prof. Müller's doctrine that "the narcotic action of opium does not react from a particular point of a nerve on the brain.") Apply it to the surface of the brain, and it instantly lessens the action of the heart, and capillary blood vessels, &c. Now combine these phenomena, when opium exerts its direct action upon the stomach, and indirectly upon the heart, capillary system, &c., and consider the natural relations between the stomach and nervous centre. Take a substantial, *physical* fact, as supplied by the advocates of absorption. Thus:—

"It is *very singular*," says Sigmond, "that a pill of opium, administered at night, will be VOMITED UP in the morning, *after having produced its narcotic effect*. This is an observation which Van Sweiten originally made." SIGMOND'S *Lectures*, in *London Lancet*, 1836-7, p. 423.

The phenomenon, however, ceases to be so "*very singular*" the moment my doctrine is admitted.

"I am acquainted with a physician in London," says Sigmond, "who, on taking opium, although in a very minute quantity, will have over the surface of the body a scarlet efflorescence." — *Ibid.*

Is not this phenomenon due to the same principle as that which is concerned when indigestible food occasions analogous eruptions, or when they spring up, as in infancy, especially, from gastric and intestinal derangements?

The snuff which regales the nose, and the tobacco which equally delights the mouth, are violent poisons to the intestinal mucous membrane; and the constitutional results harmonize with the local effects in either case. Again, if remedial, or poisonous

substances act by absorption, why is tobacco smoke so innoxious when inhaled by the lungs, and yet so deleterious when swallowed, or when conveyed into the rectum? Most remedial agents, indeed, produce constitutional effects according to the natural vital modifications not only of the mucous, and other tissues of different parts, but of one continuous tissue, as the mucous membrane of the eyes, nose, fauces, œsophagus, stomach, small and large intestines, larynx, trachea, and lungs. Where would philosophy be; where our interpretation of these various consequences, if we followed the chemist in his physical views of life? What would tobacco affect in such a case? Would it nauseate by affecting chemical affinity, or cohesion, or elasticity, or would the nose or the mouth enjoy through any such properties of matter,—or would galvanism help our understanding? Is it through any such properties that we feel the smart when the fire burns? Does not Pereira supply an important fact against his general doctrine of operation by absorption when he defends a moderate practice of opium smoking,—especially as the whole volume of smoke is drawn into the lungs? (*Mat. Med.* p. 1293.) Shall we not rather look to what is known of the natural modifications of irritability in the mucous tissue of different organs? If opium offend the stomach, the principle is the same as when urine excoriates the membrane of the lungs, and thus produces the most violent constitutional effects. But the distinguished author above quoted shall lay down our principle himself. Thus:—

“Sir B. Brodie,” he says, “found that an infusion of tobacco, thrown into the rectum, paralyzed the heart, and caused death in a few minutes. But if the head of the animal be previously removed, and artificial respiration kept up, the heart remains unaffected; proving that tobacco disorders this organ through the medium of the nervous system only.” (*Ibid.*, p. 869. See, also, my note, p. 42.)

Should we not rather say, through the medium of the brain in its connexion with the spinal marrow, whilst other parts may be sympathetically affected through the spinal marrow or even the ganglionic system, alone. (*See Med. and Phys. Comm.* vol. 1, p. 570—572.) And now contrast with the foregoing peculiarities of tobacco and opium, the fact that the inhalation of the fumes of hyosciamus produces vertigo, tremors, laborious respiration, &c.; and that hydrocyanic acid, in the quantity of a drop, or in vapour, on account of the coincident relations of its virtues to the naturally modified organic properties of various

parts, is instantly fatal, whether applied to the mucous tissue of the eyes, nose, mouth, stomach, or lungs. And so of the spirituous extract of nux vomica. If absorption be good in some of the cases, it should be equally so in the others. (*See extract from Bichat, p. 36.*) Consider, too, how the habitual use of narcotics reduces the susceptibility of the stomach to the influence of each one, respectively, and not to the others, and how the constitutional effects go on, *pari passu*, in the ratio of the local effects. And consider, also, how music assuages suffering, or the expectation of the dentist relieves the tooth-ache. And why, according to the doctrine of absorption, should not medicines produce the same constitutional effects when injected into the bladder, as when administered by the stomach? Are you doubtful as to the manner in which certain substances produce their constitutional effects, when applied to the skin, as mercury and tobacco, for example? Consider the foregoing case of hydrocyanic acid; or how an issue relieves deep seated inflammation; or, again, how belladonna, or hyosciamus, when applied to the lids of the eyes, as when to the stomach, produces dilatation of the pupils.

Again, let us observe the constitutional effects of tartarized antimony, when administered in small and repeated doses. This substance possesses, in a general sense, the power of lessening the irritability of the stomach, (in relation to its own virtues,) where the doses are small at first, and gradually increased. From this principle, indeed, results the necessity of increasing the doses as far as they may be borne without nausea, for the purpose of maintaining the same influence upon disease as is exerted by the first and smaller doses. In this way, in certain affections, as in croup and rheumatism, we may sometimes rapidly increase the doses from the sixteenth of a grain to two grains, although the first dose shall have actually produced vomiting, whilst the two grains are borne without nausea. It is also certain that this progressive increase of the remedy, as far as may be admitted by the stomach, is indispensable to the full influence upon disease which was exerted by the smaller doses before the remedy had subdued the irritability of the stomach.

Now were the physical, and not the physiological, doctrine true, there should be no necessity for this regular and rapid increase of the doses. The nearer, indeed, each dose approaches the point of nausea, so will the general arterial excitement, and

local inflammations, be held in subjection; from which it is plainly manifest that the remote effects depend upon the amount of influence produced upon the stomach. And so of opium, and all the narcotics, and, indeed, of various other agents which are freely assumed to operate through the circulation.

But again on the contrary, we may obtain an exactly opposite series of results from tartarized antimony; by which we prove our proposition by the converse of the foregoing phenomena. We may begin the treatment by one-eighth of a grain without producing nausea; but in an hour or two afterwards, a repetition of the same dose nauseates the stomach, and prostrates the whole system. Again, at the same interval, we repeat the same dose and vomiting ensues, accompanied by still greater constitutional effects. We then reduce the quantity to the twelfth of a grain, and again we have nausea and vomiting, with still greater constitutional results. We go on to reduce the dose in this manner, and, as I have witnessed in adults, it has been necessary to diminish the quantity to the thirtieth part of a grain to avoid protracted nausea, and a general prostration of the system. Here, then, the remedy not only continues to nauseate the stomach in greatly diminished doses, but, as in the opposite case, there is a constant ratio between its impression on the irritability of the stomach and its constitutional influences and its special effects on diseased remote organs. However the dose may be diminished, so long as it impresses the irritability of the stomach, it breaks down the general arterial excitement, and often overthrows inflammation just as fully, and rapidly, as when two grains are administered with a similar effect upon the stomach. Nor is this all which antimony opposes to the doctrine of absorption; since in the cases first supposed, when it finally produces nausea after repeated and gradually increased doses, it does not reduce the irritability of the stomach after that dose, as after the beginning of the remedy, and when it did not produce nausea. On the contrary, the gastric irritability is now brought up to a full relation to the remedy in that last dose, where it either remains permanently for some time, or is quite as apt to increase in susceptibility to the antimonial influence, so that it may be necessary to diminish the next following dose to avoid a renewal of the nausea, and perhaps vomiting. In the meantime the effects on the constitution, and on remote disease, are exactly conformable to the amount of influence upon the stomach.

Pereira has rendered his valuable work on *Materia Medica* liable to the objection which I am now considering, as he has, also, to that of reasoning from the effects of remedies on man in health, and even upon the naturally modified constitution of animals and plants, to the altered susceptibilities of man as they exist in disease. (1) Of tartar emetic, he says, we do not know "the mode in which it produces its curative effects." And again,

"Shall we deny the efficacy of bloodletting in inflammation, of mercury in syphilis, of cinchona in intermittents, and of a host of other remedies, simply because we *cannot* account for their beneficial effects? The fact is," he continues, "that in the present state of our knowledge, we cannot explain the *modus medendi* of a large number of our best and most certain remedial agents." (*Pereira's Mat. Med.* vol. 1, p. 417. 1839.)

This supposed ignorance is mostly predicated of the failure of detecting the medicines in the circulation; but will it apply to such observers as explain their *modus operandi* on other principles, and in conformity with well established facts? If "bloodletting be efficacious in inflammation, mercury in syphilis," &c., they are so through great and immutable laws; and shall we rest in ignorance of those laws because we cannot deny the efficacy of the remedies? Is it not this very common representation of the topics before us, and of the phenomena of living beings, which has led to so general a disregard of the great principles in medicine, and to the revival of the exploded creeds of the iatro-chemical and iatro-mechanical philosophers? Or is it any argument against the interpretation of the properties and laws of organic beings, of their modifications in disease, of the *modus operandi* of remedial agents, as set forth by one inquirer, that fifty different and conflicting systems have been projected by others? Such, indeed, must be the position of every disputed topic when universal truth shall ultimately prevail. The argument, therefore, however common, is necessarily fallacious.

There is no objection to admitting that all remedial and morbid agents find their way, very scantily, into the circulation, excepting as it regards the matter of fact, and a respect for those principles which nature has ordained for their exclusion so far

(1) Our able author, however, sometimes sustains the physiological doctrines. Thus, of Elaterium, he says that, "in cerebral affections, such as apoplexy, mania, &c., elaterium, as a drastic purgative, sometimes proves serviceable on the principle of counter-irritation." (*Ibid.* p. 1088.)

as to prevent their ingress in injurious quantities. (*See this question largely examined in my Essay on the Humoral Pathology.*) No conclusions, as I have shown, can be formed from the effects of injections into the circulation; which are the rudest facts in relation to a topic of this nature. It therefore becomes the merest assumption to affirm that the minute proportions of medicines, which may steal their way through the well guarded portals of the organism, produce those remarkable results which we witness after their administration by the stomach; whilst we are met at the threshold of the inquiry by the clearest interpretation of their *modus operandi* in the perfectly demonstrable laws of sympathy, in a stupendous display of the operations of the nervous power in the natural conditions of the body, and as modified by a vast variety of experiments, and by the morbid processes that are perpetually before us. I have formerly endeavoured to indicate how derogatory to medical philosophy is the doctrine of operation by absorption,—how pernicious its practical tendencies.

Again, take the grand characteristics of the cinchonas, arsenic, calomel, and the whole group of agents for intermittent diseases. Of cinchona, Pereira says, (after having expounded its operation as a tonic through the process of absorption,) that in intermittent diseases its "*methodus medendi* is quite inexplicable." (*Ibid.* vol. 2, pp. 1002, 1006. 1840.) But, is not its mode of operation just as intelligible in one case as in the other? Does not the whole system of nature, where common results are concerned in any integral part, enforce the belief that the same laws are concerned in both cases; and do not all the relative facts in physiology, all that is known of the properties of life, and of the constitutional effects of vital stimuli of any denomination, proclaim the fact, and that nature is just as consistent in this instance, as she is in the simple principles which determine the phenomena of gravitation, of chemical affinity, of the attraction of cohesion, of repulsion, &c., or, in more sensible physics, of electricity, of light, of magnetism, &c.? If we refer, as does Pereira, to the effects of cinchona as a tonic, upon the healthy system, we must explain the *methodus operandi* before we can apply it in the least to any parallel effects upon morbid and enfeebled states of the system. But we may not speak of "augmentation of cohesion of the organic mass," &c. (*Ibid.* p. 1002.) These are only effects of an antecedent operation, in which the

whole *modus operandi* consists. But the mode in which cinchona produces its effects in the perfect organism being just as obscure as in diseased states, we start with our interpretation of its *modus operandi* in intermittents, just as we do of the mode in which cinchona produces its fullest effects in health; or raises the vigour of the stomach, sharpens the appetite, and braces up the animal man, in dyspeptic affections.

Now the mode in which cinchona accomplishes these last results is no more obvious than its action as a febrifuge. One must certainly be as plain as the other, since the essential influences and changes are exerted upon the organic properties of living parts, which are governed by simple and immutable laws. To explain the operation of a given cause upon two principles where the results are of the same genus, and nearly of the same species, would be to disjoint nature completely, and to render her a deformity.

With this fundamental principle, we move forward to the interpretation of the effects of cinchona when it exasperates or produces disease; and so of other morbid agents. All the results, as they vary from those which follow the ordinary stimuli of life, depend upon the mutability of the organic properties and actions. Upon these, morbid causes, like the natural vital stimuli, make their whole impression; but they go farther in that impression than the natural stimuli of life. That is to say, they make their impression so profoundly, and in virtue of their peculiar attributes, as to alter the natural condition of the organic properties and actions; and this alteration constitutes disease. All that follows are but mere "sequelæ." Remedial agents, as we have seen, are capable of doing the same thing; and when direct in action, they operate upon the same principle. It is for this reason, therefore, that they produce disease in the healthy organism; and when they contribute to the cure of disease, it is in virtue of that morbid action which they exert on healthy parts. They are a class of morbid agents, however, which produce only such diseases, in health, (if not administered in great excess,) as are of a transient nature; and when, therefore, administered for the cure of disease, they induce a morbid state more favourable than the pre-existing to the natural tendency of morbid organic properties and actions to return to their healthy standard.

Thus we get at a common principle of the *methodus operandi*

of cinchona as a *tonic*, as a *febrifuge*, and as a morbid agent; and it is equally applicable to all remedies which possess absolute remedial virtues. This philosophy enables us at once to understand how arsenic, cobweb, opium, alcohol, moral emotions, and almost every thing else, are, like cinchona, more or less curative of intermittent fevers; and though the alterations which are directly instituted by these various agents are unlike in all the instances, and correspond with the peculiar virtues of each agent, each one induces such changes in the organic properties as enable them to take on their natural tendency towards a state of health, — some being more conducive than others, and either liable to exasperate the disease. We thus see, also, how it is that our remedies must be well adapted to the existing pathology, or they will prove morbid; since their operation is as well regulated by the nature of the morbid conditions as by the virtues of the remedies.

That there is a *methodus operandi*, in all the foregoing cases, is too certain to be questioned; and such being the fact, it is quite a becoming occupation for the human mind to interrogate its nature; or as Bacon has it, “it is the Glory of God to conceal a thing, and the glory of man to find it out.”

I will now present a comprehensive example which illustrates the foregoing doctrines. A seton, passed through the skin of the neck, or even of the arm, removes inflammation of the eyes. In this instance, nothing can possibly enter the circulation, but the whole influence of the seton upon the eyes must be exerted through the medium of the brain and spinal cord. By tracing out all the effects of which this seton is capable, we may show that it involves all the principles which are concerned in the production of disease and its cure.

In the first place, the seton establishes an inflammation in the part of the skin in which it is inserted. Here we have the whole interpretation of morbid agents in producing their primary diseases. Like the seton, all others act upon the irritability of parts, to which they are applied, alter its nature, and involve the other organic properties in corresponding changes, when a change of function ensues as a consequence; and then may follow a variety of physical results.

Now let us consider the seton in its curative aspect, as it relates to the ophthalmic inflammation. The morbid state of the skin operates as a peculiar stimulus, the result of which is trans-

mitted to the cerebro-spinal axis, where it develops and modifies the nervous power, which is then reflected upon various parts. But the intensity of the nervous power, thus developed, is not sufficient to alter the organic properties of any part excepting the susceptible ones which conduct the inflammatory affection of the eyes through their instruments of action, and therefore no sympathetic disease is produced. But irritability being preternaturally susceptible in the inflamed eyes, the nervous power operates with effect upon it, and alters the nature of that and other properties so as to enable them to return to their natural state; and thus the inflammation subsides.

We will next see how this seton may become the cause of sympathetic diseases in remote parts, and we shall then, also, have the whole of the principle which is ever concerned in the development of secondary diseases; and we shall see, too, that the principle is precisely the same as that which concerns the curative effects of remedies when they operate upon remote parts through the medium of another part; as in the curative effect of the seton upon the inflamed eyes.

Let us then suppose that the seton is permitted to remain in the neck after it has accomplished the cure of the eyes, till, finally, it excites a severe degree of inflammation in the surrounding skin. By-and-bye, we find the patient beginning to lose his appetite, the tongue coats up, and other marks of a diseased state of the stomach set in. This organ, therefore, has become involved in disease in consequence of the neglected and irritative state of the seton. Still, however, the mischief is allowed to go on, and the eyes, which had been relieved by the seton, again become inflamed. The seton has been the essential cause of this round of phenomena; and since nothing can have been introduced into the circulation, from beginning to end, we must look to the nervous influence for the remote developments of disease, as in the former case, for the curative results. The seton, after the cure of the eyes, had taken on a higher and modified state of inflammatory action, and it transmitted to the brain and spinal cord such influences as developed the nervous power in greater intensity and a more morbid condition. This state of the nervous power, being reflected abroad, fell with greater force upon the stomach than on other parts, from its peculiar susceptibilities, and its close natural relations with the skin and cerebral system. The stomach has also the eyes much under

its control, and the eyes are now particularly liable to be injuriously affected by sympathies propagated from the stomach on account of their recent inflammation, which left them in a more than usually susceptible state. The stomach, therefore, in transmitting its morbid impressions to the cerebro-spinal axis, coöperates with those from the seton in increasing the nervous influence; which, being determined with a morbid effect upon the eyes, produces the ophthalmic inflammation. (*See example of hydrophobic virus, in Med. and Phys. Commentaries; vol. 1, p. 499.*)

We have now to consider the natural tendency of the properties and actions of life to return from diseased to their healthy states. The seton, as we have seen, is the sole cause of the new developments of disease in the stomach and eyes, and these effects are maintained by keeping up the irritative inflammation of the skin. If, therefore, we withdraw the mechanical irritant from the skin, the inflammation of the part will subside spontaneously; and having thus removed the exciting cause of disease in the stomach and eyes, these parts, also, return spontaneously to their healthy states. Thus it is, also, that the irritation of setons, issues, blisters, &c., when applied over the joints, &c., for the removal of inflammation of the ligaments or other tissues, may, after having greatly fulfilled their purpose, ultimately keep up a degree of the disease, or increase its intensity. But, if the skin be now healed, the disease will subside spontaneously,—the very healing of the skin reflecting salutary influences. This recuperative law lies at the foundation of therapeutics, and it shows us that the first and greatest step in the treatment of diseases is to remove their exciting causes; when nature may require no other assistance from art.

The only remaining consideration to complete the essential philosophy of the operation of remedial and morbid agents, relates to the direct action of remedies in curing diseases of parts to which they may be applied. If an emollient poultice, as it is called, or opium, or leeches, &c., be applied to the inflamed skin, they may hasten the subsidence of the inflammation. This is done by their direct alterative action upon the diseased properties of the part, as in the case of morbid agents; and in proportion to the subsidence of the primary affection may be that of the sympathetic diseases. But, the sympathetic affections may be also hastened in their decline by the direct appli-

cation of remedies to the sympathising parts; or, we may contribute to the cure of the whole by addressing remedies directly to one of the organs which has been sympathetically involved, as to the stomach in the foregoing case; or, the sympathetic affections may go on independently of the cure of the primary disease, and require a distinct treatment; or, it may be necessary to cure them first before the primary disease can be removed. The diseased state of the stomach, for example, in the foregoing case, may, in its turn, establish a morbid sympathetic influence over the seton, and thus complicate the principle as to exciting causes, and institute a mixed condition of sympathetic influences. This, in fact, is more or less the case, in most diseases, after the morbid state is propagated from the primary seat. In the example now stated, all the diseased parts act and react upon each other, each becoming a point of departure for the development of a morbid nervous influence, and each affection, therefore, contributing to maintain and aggravate the others. Other organs join in, though perhaps not essentially disturbed, and take their part in the disease, according to their degrees of affection, and more or less, also, according to their relative vital importance and constitutional relations; whilst the great movement of diseased action may be variously influenced by the contingencies which grow out of constitution, temperament, age, habits, external influences, &c.

The affection which has been celebrated under the name of *spinal irritation* is virtually, in most cases, that disease of the stomach which others have denominated *indigestion*. Where the spinal cord is the seat of irritation, the principle is involved which I have just stated,—forming an example of sympathetic affection of the nervous tissue. In most of the cases, the primary and important seat of disease is in the stomach, whilst the remedies are apt to be abortively applied to the spinal cord. The blow, on the contrary, should be struck at the gastric affection upon which the sympathies depend; and, in a large proportion of the cases, but little else is necessary than a rigorous attention to food, exercise in the open air, and regular habits.

The state of the spinal cord is not worth a local remedy in most of the cases; but, when the pain and soreness of the cord is great, an injurious nervous power may be propagated back to the stomach, and more or less relief will then be contributed by the application of leeches and blisters along the spine; or, in

fewer instances, the spinal irritation amounts to a degree of disease that must be cured before the original gastric affection will surrender.⁽¹⁾ The "clergyman's sore throat" is another example of this nature, and where the remedies should relate to the diseased abdominal viscera.

If what I have now, and hitherto, laid before the profession, be founded in nature, it is obvious that all of us, who would attain a proficiency in the science of medicine, must carry out the principle which is inculcated by the injunction, — "*nocturna versate manu versate diurna.*"

"I have not forgotten a remark," says my friend and late distinguished President of the Liverpool Medical Society, "made by a venerable professor in Edinburgh, (the late Dr. Duncan, sen.,) in one of his introductory lectures, *that a medical man must make up his mind to be a student all his life* ; and I can with truth aver, that every year, nay, every day, adds farther experience to fully confirm in my mind the truth and accuracy of the remark." — DR. THOMAS JEFFREY'S *Address to the Liverpool Medical Society*, 1835.

(1) Dr. Holland has some luminous remarks upon this subject, which it will be well for those to examine who fancy that the seat of the greatest disease is denoted by the greatest pain. His statement, that in many cases, "recovery is derived, not from remedies applied to the spine, but from steel, bark, ammonia, and valerian, cold water bathing or washing, exercise, moral remedies, &c." goes to confirm the suggestions which I have made in the text. — See HOLLAND'S *Medical Notes and Reflections*, p. 156.

PRACTICAL SUGGESTIONS.

TABLE I.

Tissues most liable to disease, especially to inflammation, in the order of arrangement :

1. Mucous,
2. Venous, (*venous congestion*),
3. Cellular,
4. Serous,
5. Ligamentous, and dermoid, (*fibrous*),
6. Glandular,
7. Lymphatic,
8. Nervous,
9. Synovial,
10. Periosteum, (*fibrous*),
11. Osseous,
12. Tendons, cartilage, dura mater, and pericardium, (*fibrous*),
13. Muscular,
14. Arterial.

TABLE II.

Parts of tissues most liable to disease, especially to inflammation, in the order of arrangement :

- | | | | |
|------------------------------|---|----------------------|-----------|
| 1. Mucous texture, | } | of the nose, | |
| | | “ lungs, fauces, | |
| | | “ eyes, | |
| | | “ small intestine, | { Ilium, |
| | | | Jejunum, |
| | | | Duodenum. |
| | | “ stomach, | |
| | | “ large intestine, | |
| | | “ uterus and vagina, | |
| | | “ bladder. | |

2. Venous texture, (forming, mostly, venous congestion,) { of pia mater, in infancy and childhood,
" liver,
" small intestine,
" pia mater of adults,
" rectum, (*piles*),
" uterus, (*phlebitis*),
" lungs, (*congestive asthma*),
" lower extremities, (*varix*),
" spermatic cord, (*circocèle*).
3. Cellular texture, { subcutaneous,
of the lungs,
" pia mater,
" voluntary muscles.
4. Serous texture, { of the lungs,
" parietes of thorax,
" parietes of abdomen,
" liver,
" small intestine,
" large intestine,
" heart and pericardium,
" cerebral ventricles,
" kidneys,
" stomach.
5. Glandular texture, { lymphatic glands,
mammæ, (*puerperal*),
salivary glands,
liver,
testis,
lacteal glands,
kidney,
thyroid gland, (*goitre*),
thymus gland,
pancreas.
6. Lymphatic texture, { of the lower extremities,
" upper extremities,
" uterus, (*see Comm. vol. 2, p. 470*),
others rarely.
7. Fibrous texture, { ligaments,
dermoid,
periosteum,
cartilage,
tendons,
pericardium,
dura mater.

- | | | |
|-------------------------------|---|--|
| 8. Nervous texture, | { | brain,
nerves,
ganglia of sympathetic,
spinal cord. (<i>See p. 63.</i>) |
| 9. Synovial texture, | { | of the knee joints,
" ankle,
" joints of upper extremities. |
| 10. Osseous texture, | { | spongy bone,
solid bone. |
| 11. Arterial texture, | { | of the brain,
arch of aorta,
" extremities,
rare in other parts. |

TABLE III.

Relative danger of high inflammation affecting the tissues of different organs, according to the order of arrangement :

1. All textures of the brain.
2. All textures of the heart and pericardium.
3. Venous and lymphatic textures of the womb, iliac and other veins.
4. Peritoneum of abdomen, *puerperal women*.
5. Serous membrane of small intestine.
6. Veins of the liver, *venous congestion in congestive fevers*.
7. Parenchyma of lungs.
8. Glandular texture of liver.
9. Mucous texture of small intestines.
10. Mucous texture of stomach.
11. Serous texture of large intestine.
12. Textures of kidney.
13. Mucous texture of large intestine.
14. Serous texture of lungs and thorax.
15. Serous texture of liver.
16. Serous texture of abdominal parietes, (*common inflammation.*)
17. Veins of lungs, (*low, or sub-active, forming congestive asthma. See Comm. vol. 2. p. 494.*)
18. Textures of bladder.
19. Mucous texture of uterus.
20. Ligaments.
21. Bone and cartilage.
22. Lymphatics of extremities.

TABLE IV.

Tissues which require the greatest extent of general bloodletting, when affected with high inflammation, — according to the organs in which they are associated, and in the order of arrangement. The remedy is supposed to be applied early.

1. All textures of the brain.
2. All textures of the heart and pericardium.
3. Serous texture of small intestine.
4. Peritoneum of abdomen, *in puerperal women.*
5. Parenchyma of lungs.
6. Serous texture of stomach.
7. Serous texture of large intestine.
8. Veins and lymphatics of uterus. (*Early.*)
9. Serous and glandular texture of liver.
10. Venous texture of liver. (*Sub-acute, congestion in congestive fever. Often more largely.*)
11. Mucous texture of small intestine.
12. Uterus.
13. Textures of kidney.
14. Mucous texture of stomach.
15. Mucous texture of large intestine.
16. Serous texture of lungs and chest.
17. Serous texture of abdominal parietes. (*Common inflammation.*)
18. Ligaments. (*Often more largely.*)
19. Bladder.
20. Mucous texture of bronchiæ.
21. Mamma, testis, parotid gland.
22. Absorbents of extremities.

POSTSCRIPT.—As a few copies only of the foregoing work have been distributed, I have thought it worth while to take a brief notice of an article with which my “Examination of Reviews” has been honoured in the July number, (1842,) of the *British and Foreign Medical Review*.

Dr. Forbes having hitherto chosen other vehicles than his own Journal for his notice of my “Examination,” we have a right to suppose that he would put forth his whole strength whenever he might bring the *British and Foreign* to bear upon the subject. But the only “point” of defence instituted is the following :

“He has actually ministered to our gratification on a point generally considered as touching all men most nearly, viz., the improvement of our exchequer. It is a fact which Dr. Paine can any day verify, by a reference to our New-York publishers, that in the quarter immediately succeeding his great advertisement of this Journal, the demand for it in America was increased one twelfth!”—(*Review*, p. 213.)

From what I have hitherto shown of the statements of Dr. Forbes, and from my knowledge of the falling off of his subscription in several instances in this country, I availed myself of the privilege in the foregoing extract, and called upon the publishers to learn how far this attempt to invalidate my “Examination of Reviews” was founded in truth ; and since, also, Dr. Forbes assumes that he is a “man of honour” to my disadvantage, I am reluctantly compelled to submit the following facts to the public.

When I sent forth my “Examination of Reviews,” I obtained from the publishers of the *British and Foreign Medical Review* in this country the names of near subscribers for the purpose of forwarding to them copies of the Examination. The list was then very respectable in this city and neighbourhood. But it now becomes my unwelcome duty to state that there are only *one hundred and twenty-one copies* on the Publishers’ list, for all North America—the United States alone having more than 20,000 physicians. These copies are distributed in the following manner : State of *New-York* 31 copies, (one being taken by myself ;) State of *Pennsylvania* 7 ; State of *Georgia* 1 ; State of *Maryland* 22 ; State of *Rhode Island* 2 ; State of *Massachusetts* 41 ; *District of Columbia* 1 ; State of *South Carolina* 12 ; State of *Connecticut* 2 ; CANADA 2 = 121.

It should be also understood that *just prior* to the publication of my “Examination,” an effort was made to improve the “Exchequer” by reducing the subscription in this country from *six* to *five* dollars. *Had there been*, therefore, an increase of subscribers, “a man of honour” would have imputed it to the CAUSE which was *intended* “to touch all men most nearly.”

Dr. Forbes is pleased to complain that, I have “carefully transmitted my publications *by post* to all the most eminent men in the profession in Great Britain, and even on the Continent.” *Hinc ille lachrymæ.*

This is in part true, so far as respects my pamphlets ; but I have, in nearly all the instances, paid for the freight and duties, not doubting that it would be an indelicacy to pay the small European postage. Until, therefore, I learn from some other source that the postage is onerous, I shall continue the same practice with the present and any future publications ; though I flatter myself that no European gentleman will think it amiss should convenience sometimes prompt me to send him a pamphlet through the post-office in this city. I may also add, that my work on the Cholera Asphyxia, of which there were 2,000 copies, and six pamphlets, (besides the present of which there are 2,500 copies,)

have been distributed gratuitously. Of my "Examination" I published 2,000. Upon the copies of this pamphlet which I sent to Europe I paid a freight and duties of about fifty dollars, though I apprehend the *nature of the work* was such as to have justified its transmission "by post" from this country. My work on the Cholera was bound, and a more bulky volume, and I therefore, at no little trouble, paid the entire expenses of its transmission to its various places of destination in Europe. I lament the necessity of these details; but it will be seen that they have been rendered unavoidable.

Dr. Forbes is also pleased to refer to my *Materia Medica*, which, as I state in the "Preface," "was not undertaken till within the last two months, and has been carried on in the midst of many pressing engagements." Indeed, the plan of the work was not conceived till within that brief period, and amongst the many engagements were seven or eight lectures a week, at the opening of the new medical school.

The only objection, however, alleged against the work, is a pretended obscurity of the "Instructions" to the reader as to certain figures and symbols relative to the "combination of remedies," which, as I state in the "Instructions," were introduced "for the sake of brevity and to impress the memory." This plan of condensation for a manual of *Materia Medica*, and relating only to the "combination of remedies," has met the approval of all, aye, even of "students," so far as my information has extended; and I shall therefore retain it in the next edition. The examples given in the Review, as the reader will find on comparison, are excessively mutilated, trickish, and rendered unintelligible.

Though my relations to a foreign Journal are of such a nature that I cannot refer to those who have honoured me with their correspondence since I published my "Examination of Reviews," I may yet say, that I have had many letters from the first medical philosophers in Europe, commendatory of my *Materia Medica*, and a multitude warmly sustaining my "Examination." I need scarcely add, that whoever will turn to my *Materia Medica* will readily perceive that Dr. Forbes has concealed from his readers the whole essential plan of the work, and the manner in which it is executed; and this the more so, as the concealment is accompanied by the declaration that the "arrangement adopted by the author is somewhat different from that of preceding authors, but not so much so as to be very noticeable by his readers." It is true, the names of the "Classes," and the "Orders in the first Class," are stated by Dr. Forbes; but this only with a view of misleading the reader as to the most important part of the work, — all the details of arrangement, by which the relative therapeutic value of all the articles of the *Materia Medica* is estimated according to experience, and set forth in consecutive order under the various classes, being *wholly original* with myself. A greater artifice cannot be detected in modern criticism.

In respect to the statement that my *Materia Medica* "is dedicated to the forbearing consideration of Dr. John Forbes, and to his justice and honour," it is hardly worth while, perhaps, that I should say that the work is dedicated to Professor Caldwell.

* * In speaking of Dr. Hall's views at page 43, as well as in my remarks upon the nervous power in its pathological and therapeutical relations, I should have referred to what I have said in my "Commentaries" on the subject of Sympathy, vol. 1, p. 157-158, and especially on the important influence of the ganglionic system of nerves in organic processes, and how this system is physiologically related to the brain and spinal cord.

July 26, 1842. + There are only 30 under the whole 980 Species

