CONTRIBUTIONS TO A NEW CHAPTER IN THE PHYSIOLOGY AND PATHOLOGY OF THE NERVOUS SYSTEM.

BY THOMAS LAYCOCK, M.D.,

Professor of the Practice of Medicine and of Clinical Medicine, and Lecturer on Medical Psychology and Mental Diseases in the University of Edinburgh.

I.—THE SCOPE AND NEED OF A NEW CHAPTER.

I ORIGINALLY intended that my promised clinical contributions to a new chapter in the physiology and pathology of the nervous system should be cases with comments, after the orthodox plan; but, on reconsideration, I find I cannot contribute satisfactorily or usefully without a preliminary exposition of certain principles. Every one becomes aware of the value of sound general principles in science, so soon as, after having passed through the inevitable ordeal of neglect, doubt, ridicule, and misapprehension which awaits all novel views, whether they be true or false, they have been successfully applied to practice. Previously to this judgment in his favour, however, the expounder of novelties and heterodoxies has a thankless duty to perform, and is not only inevitably subject to loss of time and labour, but also of what is more tangibly valuable. It is an old, old story, although it is right to say, that of late years there is much more toleration within the medical profession for new views. Nevertheless, "the wisest, virtuous, disinterested, best," are apt to resent the overthrow of time-honoured doctrines; and, although they may admit generally the necessity of general principles, yet they are not so ready to admit views so general and comprehensive that their extent is a strong objection. And this is precisely the objection to which all thoroughly general views in medicine are liable; because, being based on biology in its applications to man, its fundamental principles must of necessity touch upon, if not include, those of all the sciences. These remarks serve to explain why I deviate from my original plan with much reluctance, and are my apology for premising some general views as to the scope of my proposed new chapter.

It is now generally admitted as a fact of both philosophy and physiology, that, with every change in the mind or the consciousness, there is a change in the constitution of the brain-tissue. What that change is, and how it arises and ends, has long been a subject for metaphysical and physiological speculation. The most recent theories are based upon the correlation of the physical forces. Whatever may be the particular theory, however, one fundamental fact is common to all; viz., that, in some way or other, the changes are regulated by the laws of chemical affinity; and a specific chemical constituent of brain-tissue, the elementary body termed phosphorus, has also been fixed upon as the chief agent in the chemical changes. My new chapter, then, deals with chemical affinity and its laws, as the force in immediate relation with the mind and the consciousness, and subordinately with the correlative physical forces—viz, heat, light, electricity, and galvanism—from which it is to be distinguished. Or, placing the proposition in another shape, it inquires into the correlations of the laws of chemical affinity and of mind.

It is a fact of observation, that the nervous system has a powerful influence on some of the chemical changes which go on in the body. In a muscular act, its influence on the chemical changes of contracting muscles is direct; for, although popular language describes voluntary action as due to the will, the change in the contracting muscles is due immediately to the nervous system. The influence of the latter in the distribution of the blood (vaso-motor action) is also recognised. But there are solid grounds for the conclusion that the nervous system acts directly on the processes of nutrition not less in its own centres than in the tissues generally, and regulates not merely the distribution of the nutrient fluids (the blood, chyle, and lymph), but also the chemical changes which they undergo. This is, then, another point of inquiry in my new chapter: in other words, the trophical influence of the nervous system in relation to chemical affinity, as distinguished from its action on the circulation (vaso-motor influence).

The various processes going on in the body are so brought into relation to each other, that they conduce at least to one end or purpose—viz, the healthy existence of the individual. The purposive function of the nervous system is universally recognised in thought and voluntary motion, in reflex movements, and in vaso-motor activity; and certain

portions of it have been allotted anatomically to each duty; but there is no distinct portion appropriated to the regulation of the chemical affinities of the blood and the tissues in general, nor of the brain and nerve-centres in particular, in adaptation to ends. In my proposed new chapter, I have a place for a trophical nervous system anatomically distinct from those portions appropriated to mental activity and emotional and reflex movements, with its own afferent and efferent nerves, its own commissures and ganglia, and its own volitional, emotional, and reflex phenomena.

In the humblest, as well as in the most developed organisms, and in vegetables as well as animals, all the chemical changes are inseparable from the so-called vital forces, of which the essential characteristic is, that they operate to ends. This general law of adaptation to ends in Nature—the fundamental principle of teleology—is the guiding principle (described by the term *vis medicatrix nature*) of the natural and rational treatment of disease. But, since it implies an examination of the vital forces in their adaptive relations to chemical affinity, but more especially of the *vis nervosa*, as an adapting and regulating force, my new chapter includes a teleological theory of chemical affinity.

Any further apology for this attempt to wed philosophy to medicine would be a waste of space; it must be judged by its results. But I am satisfied, from my own experience, that this new doctrine, well studied and suitably applied, will guide observation, help to clear up many obscure questions in mental and biological science, and give greater precision to our ideas and aid to our researches and practice. And I think it will be admitted that, without the help of some kind of theory which may serve to connect physical with vital forces, and these with mind, we cannot advance far scientifically even in the study of nutrition of the elementary tissues, and of the uses of so-called alterative remedies drawn from the class of elementary bodies, such as iodine, bromine, phosphorus, sulphur, arsenic, iron, potassium. In short, the whole of organic chemistry, and its dietetic and therapeutic applications, whether corporeal or mental, must rest upon this differentiation of a cause of adaptation to ends in chemical compounds from the physical or kinetic forces which are used as the means. Nor can we find even a basis for discussing the nature of those encephalic chemical changes which coincide with mental states, unless we adopt a teleological theory of chemical affinity.

In working out an inquiry of this kind, the importance of clinical observation (using the term in its scientific and widest sense, as including all observations of morbid states in relation to the healthy conditions, and not merely an empirical noting of symptoms) cannot be overrated. It is to this field of observation that all current theories must be brought to be tested, and, if found worthy, developed into practical uses. It is by clinical observation alone that all the great phenomena of life can be clearly comprehended, or even comprehended at all. Without it, some of the most important chapters in anatomy and physiology—nay, even in biology—would be wanting; because, in fact, conscious states are the only sources of evidence of change in the body. The soul, for example, is so absolutely spiritual, that we are not cognisant of any changes whatever in its organ and seat, the brains, when they are in a perfectly healthy state. Of the thousand millions of human beings on earth, probably nine hundred and ninety-nine millions, if they inquire at all, are of opinion that, in dreaming, their soul parts from the body, or is in some supernatural state. Hence, in ancient states, there was a class of professional interpreters of dreams, who acted in accordance with the theory. The brains were so thoroughly ignored, that they had no part in any hypotheses whatever. It is for this reason that speculative philosophy has ever moved in a circle; so that its history is a record rather of constantly recurring and opposing doctrines, than of progress. It is not surprising that, under these circumstances, the hallucinated and insane have been either held to be under supernatural influences on the one hand, and supernaturally inspired with knowledge, or the victims of demoniacal beings on the other; or, as more lately, punished as vicious animals. If cerebral disease and disorder had not been manifested by pain and mental derangement, physicians would to this day have remained as ignorant of the functions of the nerves, spinal cord, and cerebral hemispheres, as they are of those of the cerebellum, which are still a mystery, because the symptoms and signs of disordered function of that important organ are negative as to feeling, thought, and will.

How much depends, therefore, upon the great body of the profession, in all that concerns the advancement of the medical art, cannot be a matter of controversy. It is of equal importance, however, to remember that desultory, disconnected observations are of little value. The observer requires to know both how and what to observe, and this knowledge is only to be found in general principles. Without these, the most obvious relations of phenomena will pass unnoticed. Desiring to know something of headache, I took up an essay on cephalalgia or

headache, published at Tubingen in 1789 (Ploucquet and Baer, *De Cephalalgia in Specie Digesta, Script. Neurol. Minores*, tom. iii, p. 294). The various kinds are classed under four sections; viz., Idiopathic, Sympathetic, Compound, and Complicated. Under the idiopathic alone there are sixty-four species or varieties of headache enumerated, according to cause. And I venture to say, no one known cause of the present date is omitted from the list. So that the Clinical Society (newly established) would find the essay a perfect mine of facts and references to facts. Yet it is almost worthless for practical purposes, because it wants the harmonising power of vivifying principles, such as modern anatomy and physiology would supply. Of the sixty-four idiopathic kinds of headache, fifty-six are referred to heads as they are caused by changes in the "solids" or "humours"—i.e., chemical changes—of the body; and the remaining eight are referred to congenital malformation, degeneration of substance, and destruction of parts—the two former being developmental. Now, the only solid principle for the arrangement of clinical observations is to be found in the general facts of physiological anatomy, enlightened and harmonised with those of clinical observation, as the history of this cephalalgia clearly shews. The fundamental fact in cephalalgia is, that there is pain in the head somewhere; but Zinn had shewn, by vivisection, nearly half a century before (1743), that the cerebrum, cerebellum, corpus callosum, and dura mater, are insensible; while, in 1753, Castell, instituting vivisections at the instigation of Haller to determine the sensibility of parts, shewed that the pericranium (or periosteum of the cranium) and the pia mater were also insensible to injuries.* Here, then, was such discord between the results of clinical observation and of experimental research, that the conclusions neutralised each other; even that corporeal conditions coincided at all with pain was not clearly, or in any degree, determined. And by many to this day mental pain is held to be something metaphysically and physiologically distinct from corporeal pain; whereas the two painful states only differ corporeally as to causes and seat. Mental pain is brain-pain due to changes in the brains which cannot be excited by merely physical means, as laceration, slicing, and the like, and to which they are consequently insensible. Pain, in short, was practically relegated to metaphysics; and metaphysics was only thought.

Therapeutics are just as chaotic, for want of guiding principles; the uses of arsenic afford an example. They are almost of universal application. 1. As to nervous disorders: Arsenic has been found useful in melancholia, chorea, and certain spasmodic diseases, in hemiplegia, neuralgia, neuralgic menorrhagia, gastrodynia, angina pectoris, hooping-cough, hay-fever, and cerebral "plethora". 2. It is a most valuable remedy in all intermittent fevers and in periodic diseases. Also, in chronic diseases, including the whole group of skin-affections, from lupus to chloasma; in hypertrophy of the heart (combined with antimony); in chronic bronchitis; and in catarrhal ophthalmia. 4. In diathetic diseases of diverse kinds, as phthisis, acute and chronic gout, chronic rheumatic arthritis, dropsy, cancer, gout, leprosy. I know of no current theory available to explain these diverse uses of arsenic. Nor does a comparison of its medicinal uses with its physiological effects help us. No poison is more deadly; in small doses, it excites violent pain and inflammation; in larger, it is not only rapidly destructive to life, but even hinders the ordinary chemical changes which commence when life ceases. Yet it is taken as a condiment and cosmetic, and given to horses to beautify their coats. A rapid glance at all these varied facts suffices to shew that, to solve scientifically the problem of the exact *modus operandi* of arsenic, all the great fundamental laws of nutrition and transformation of tissue, in relation to chemical affinity, must be known. And even a moderate empirical knowledge of its uses, implies a knowledge of much in this direction not yet distinctly theorised about. It evidently acts on both the nervous system and on the tissues themselves; but how does the action on the nervous system influence its action on the tissues, and to what extent? In gout, for example, in phthisis, in leprosy, in chorea, and its rheumatic complications? In all these, there arises the pressing practical question as to the physiological relations of the nervous system: 1, to transformations and to diathetic degenerations of tissue with the production of morbid chemical compounds, like lactic acid, uric acid, tubercle, gummy deposits of syphilis, plastic exudations in leprosy; 2, to changes in the capillary circulation and the production of fever, heat, sweats, dropsies, congestions, inflammations; and 3, to the influence of mental states on corporeal changes. These are subjects of therapeutical inquiry ever recurring from generation to generation and making really but slow progress.

What I have said of arsenic applies with equal force to those remedies which act specially on the nervous system. Alcoholic drinks may be mentioned as an example. I have found brandy in quickly repeated half-ounce doses arrest profuse pulmonary hæmorrhage after every other

means had been tried and when death appeared imminent; yet *à priori* it would hardly be expected to act as a pulmonary styptic. And to how many well known uses are alcoholic drinks put—medicinal, dietetic, hygienic? They restore to health of body and relieve delirium and weakness of mind; yet, under given circumstances, how destructive to the healthy condition of the tissues in general and of the mind itself. Perhaps drunkenness is, directly or indirectly, the most common cause of insanity and of those congenital defects in brain-nutrition and function which involve the descendants of drunkards. These, indeed, are the material causes of much of the moral defects and degradation which infest modern communities. Very earnest attention, therefore, has been directed to drunkenness, in its moral, social, and medical aspects, of late years; yet how little do we solidly know of the action of intoxicating drinks on the tissues and nervous system in general, and on the brain in particular. The reason for such waste of labour is to be found in the want of good guiding principles. In the absence of these, there is not even a sufficient differentiation of the different kinds of intoxicating drinks. All are often indefinitely termed alcoholic, whether fermented or distilled; as if alcohol were the sole injurious agent. Yet, of both kinds, some are saccharated, some spiced, and some embittered by what are really powerful nervines, although vaguely termed stomachics, which, when habitually taken, deeply influence the nutrition and functions of the brain and nervous system. Of this class, are wormwood in the *sirop d'absinthe*, hop, camomile, quassia, nux vomica, gentian, in bitter malt liquors and "bitters" of distilled drinks. The whole group of wines from the fermented juice of the grape not only differ in composition from distilled and other fermented drinks, but, for a like cause, even from each other, in their influence on the nervous system, and, through it, on the tissues generally. This remark applies also to mead, cider, and perry. Now, to say nothing of the elementary bodies in intoxicating drinks, the bitter class of drugs includes a whole group of alkaloids, the result of chemical combinations in plants, and which owe their peculiar action on the nervous system to varieties in the combining equivalents of three or four elementary bodies; yet so little is imagined even as to their chemical relations to the brain and nerves, that comparatively few practitioners think of quassia and gentian and hop as other than harmless "stomachics." Even wormwood is supposed in France to give no additional poisonous quality to the mischievous *sirop d'absinthe*. Practically, wines are recognised to have different dietetic and pathological qualities; but I think nothing is known of the corresponding differences of composition, except, perhaps, as to phosphorus. To supply this want of guiding principles, then, must always be a chief object with those who appreciate the full importance of clinical observation, as, indeed, it ever has been. It is a serious defect in medical education that the history of opinions and methods is not taught; for history teaches what the reasons of failure are, and how they may be avoided. The result is a wearisome repetition of methods and of doctrines that have been already tried and found wanting. It will be of use, therefore, to examine briefly into what has been done in regard to the subjects of the vast chapter I propose to illustrate, in so far as regards the influence of the nervous system on nutrition.

SANITARY CONDITION OF THE CITY.—The annual report on the sanitary condition of the City of London has just been presented to the City Commissioners of Sewers by Dr. Letheby, the medical officer of health. A great deal of it is occupied with matters relating to the visitation of cholera in 1866. Of the 2,137 deaths, 809 were in the Eastern Union, 572 in the Western, and 756 in the City; the proportions being 19.6 per 1,000 of the first-named union, 21.4 of the second, and 16.3 of the third—the average for the whole City being 18.6. In the whole of England the average death-rate is 22.5 per 1,000 of the population, and in the chief towns and town districts of England it is 24.6, while in country districts it is 20.1. Measured, therefore, by these standards, the death-rate is remarkably small; and it is smaller than that of any considerable town in the kingdom. Of every 1,000 deaths in the City during the year 170 were among infants of less than a year old, and there were 305 among children at less than five years of age, while 74 were at from five to twenty years of age, 147 from twenty to forty, 193 from forty to sixty, and 271 at sixty and upwards. The infant mortality is undoubtedly excessive, although it is not so large as it has been in former years; in fact, it has declined from an average of 185 per 1,000 of the children born to 152. This is close to the average (151) for the whole metropolis, but it is a little above the average for all England (149). In the eastern division of the City the infant mortality has reached to 168 per 1,000 of the births, while in the western it has been but 147 per 1,000, and in the City proper only 136. These numbers represent not only the differences in the sanitary condition of the several districts, but they also represent the poverty and other necessitous means of the population.

* Both these essays are in *op. cit.*, vol. iii.