UNIVERSITY AND EDUCATIONAL NOTES

DR. GEORGE ALFRED LAWRENCE, the neurologist, of New York City, who died on December 28, made bequests of $1,000,000 to Stanford University, his alma mater, and to the All University Club, of which he was an organizer. In addition Dr. Lawrence willed equal shares in his residuary estate to Stanford University and the All University Club.

AN anonymous donor has contributed $50,000 to establish a chair of preventive medicine in Queens University, Kingston, in honor of Dr. Arthur Elliott, an alumnus.

THE Kansas State Agricultural College has been placed upon the list of institutions of higher education approved by the Association of American Universities.

AT the University of Virginia, Robert E. Lutz has been appointed associate professor of organic chemistry, Lauren B. Hitchcock associate professor of chemical engineering, and Lyndon F. Small research associate in organic chemistry.

DR. ALVAH R. MCLAUGHLIN has severed his relations with the department of physiology and pharmacology of Michigan State College in order to accept the position of physiologist and pharmacologist at the experiment station of the University of Wyoming. He will assist in the investigations of plants poisonous to livestock.

DR. THOMAS P. HASLAM has been appointed associate professor of pathology at Baylor University College of Medicine, Dallas, and medical director of the Baylor Hospital.

CHARLES E. BRAUN has resigned from the research staff of the Barrett Company to become assistant professor of organic chemistry at the University of Vermont.

DR. JAMES HENRY DIBBLE, professor of pathology and bacteriology in the Welsh National School of Medicine, Cardiff, has been appointed to the George Holt chair of pathology in the University of Liverpool. Professor Warrington York has been transferred to the Alfred Jones chair of tropical medicine.

DISCUSSION AND CORRESPONDENCE

IS THIS SCIENCE OR METAPHYSICS?

THE Silliman lectures at Yale University have been the avenue through which some of the masterpieces of modern science have been published. Among these lectures are the "Integrative Action of the Nervous System" by Sherrington and "Respiration" by Haldane. Among the other lecturers on this foundation appear the names of Krogh, Morgan, Thompson, Nernst, Rutherford, Arrhenius and Bateson. In such company the highest standard of true science should be expected. This expectation is further justified by the fact that the Silliman Foundation expressly provides "that lectures on dogmatic or polemical theology should be excluded." It is, therefore, to be noted with regret that the lectures in this series recently delivered by Professor Lawrence J. Henderson are seriously infected with that most insidious disease of scientific thought, metaphysics.

The subject of the lectures now published,[1] according to the opening paragraph, is "the red blood of vertebrates," to be studied "both as a physico-chemical system and as a tissue," considered both in the "interrelation of its physiological functions" with other parts of the body and as "an illustration of organic integration and adaptation."

A general conception of protoplasm from the standpoint of a physicochemical system is then presented, and this is followed in the second chapter by a statement of the components and functions of the blood as a type of protoplasm or of the nearest approach to protoplasm that has yet been analyzed with any degree of thoroughness. The discussion then turns to a presentation of the acid-base equilibrium of blood as depending upon the balance between sodium bicarbonate and carbon dioxide in simple solution. The influences exerted by the cells of the blood and by the proteins and other buffers of the plasma are brought out. Up to this point dissociation curves of the usual form are chiefly used in the graphical presentation of the facts. The number of factors involved in the physicochemical equilibrium in so complex a system as blood is found, however, to exceed the limits of ordinary graphic representation; and on this account the author has recourse to the use of nomograms as devised by d'Ocagne, in which it is possible to represent the interrelations of a larger number of factors. The shift of the equilibrium within the blood during the normal respiratory cycle is shown in a series of 100 successive diagrams, and this is followed by two other series of diagrams, one of five and the other of twenty-one separate figures. In fact the total number of figures in this book, exclusive of the appendix, is 225, and the tables are eighty-six in number. The presentation of the material is thus extremely full. Following the chapters dealing with the influence of respiration and with the blood in circulation are chapters presenting evidence regarding readjustments in the blood during

[1] "Blood, a Study in General Physiology." By Lawrence J. Henderson, Yale University Press, 1928. Pages 397, price $5.00.

muscular work and in disease, and on the blood of non-mammalian species of animals.

In the last chapter the conclusion is reached (page 373) that

> the elementary condition of the phenomena of life is a particular kind of physico-chemical system. A description of this kind of system so general as to be almost but not quite useless is given. . . . Although the greater part of this book has been devoted to the elucidation of the properties of this class of systems a comprehensive and detailed description is as yet unattained. . . . Some will say that the elementary condition of the phenomena of life is the cell. Others will prefer a metaphysical definition.

Such, in brief, are the contents and professed objects of this book. It is a work which, for several reasons, is peculiarly difficult to evaluate. It will be hailed by some as a masterpiece—the more admiringly, perhaps, the less they understand it. But it is perverted from the splendid service which it might have rendered by the obscurity with which the general ideas are presented, by the behavior of the author toward that investigator who in this field was his chief predecessor, and by his attitude toward his readers, whom he seems to desire to impress rather than to inform. Certainly few who are not already well informed on this subject will find it helpful to read such a sentence as the following (page 15):

> Thus the stability of the alkalinity of blood and protoplasm may be measured by the value of a mathematical function which is implicit in the general mathematical description of the equilibrium between acids and bases, and the regulation of alkalinity, that is to say, its relative constancy over a long period of time and under widely different circumstances, may be quantitatively described if we extend our studies from the physico-chemical equilibria of blood and protoplasm to the interaction of these with the activities of the lung and the kidney, and with the varying processes of metabolism.

In extenuation of this manner and style it is only fair to add that these faults of the book are faults only when it is considered as science. They are quite in the manner of metaphysics, and the author indicates both on the first and last pages of his text that he conceives of science as attaining its final aim only when it becomes metaphysical or has passed through a stage of metaphysics. Thus on the first page of the book he describes his conception of the development of the sciences as follows:

> At first descriptive and classificatory, then rational, in this twentieth century some will say that they are destined to become metaphysical. But before they can attain to this last condition it seems probable that they must pass through a stage in which all is clarity, simplicity and order, where there is no room for philosophic doubt and where, by a singular paradox, the adoption of approximations and philosophically dubious abstractions yields certainty, or at least the closest approach to certainty that man has ever known.

This statement might have emanated from Theophrastus Bombastus von Hohenheim, the celebrated medical writer and mystic of the sixteenth century, generally known as Paracelsus.

It may be that in some other fields, for example mathematical physics, "philosophically dubious abstractions yield certainty," particularly if no experimental test is possible. But in the biological sciences with their infinite variety of phenomena all real advance has been due to experiment and observation. Doubt and question have been the mainsprings of progress; and "dubious abstractions" can be regarded only as perversions. Let us see what the author's method comes to. He says (page 17):

> Far from seeking to avoid or to minimize the adaptive character of organic phenomena, we should, I believe, invariably take this for granted. The law of adaptation in organisms, founded upon the fact of survival, seems to be quite as well established as the second law of thermodynamics, and almost equally serviceable. Caution is, however, necessary and *Candide* should never be forgotten, for one must carefully avoid in studying the microcosm, the ancient fallacy of the best of all possible worlds.

Ths passage has already been hailed even by an able physiologist as the impressive dictum of "one of the most profound of modern thinkers." But stripped of its metaphysical and pedantic form of expression it comes to absolutely nothing more than the idea expressed nearly seventy years ago by a quite unmetaphysical observer of nature in a quite unmetaphysical book, Charles Darwin in the "Origin of Species." The words above quoted are simply a statement of "natural selection" with no greater content or connotation than the definition and description of Darwin's central idea as presented in simple language in any elementary text-book of biology.

The difference in the method of thought and the presentation of fact in the "Origin of Species," or in any other truly scientific work, and the method employed in the book before us is that true science invites experimental tests and if possible correction or even refutation at the hands of others. In such metaphysical science as this book, on the contrary, nearly every general statement that could be tested experimentally is provided with "weasel words" through which, if the experiment is adverse, the statement can be explained as meaning something different from the sense in which it was understood initially. It can thus be shown even to have foretold

the result of the experiment, after the event; for, as the author would say, "The principle remains the same." To criticize the scientific standpoint of this book would, therefore, be like shooting at a disappearing target.

But if the discussion of the regulation of the composition of the blood is taken for what it seems to mean, it presents a conception of equilibrium which is sound physical chemistry, as it deals with stationary states, but is essentially erroneous as a description of physiological functions, since the characteristic equilibria of life are dynamic. The energy equilibria of the organism are as much in flux as the chemical equilibria of metabolism.

Evidently the author of this book in lifting the subject of the regulation of the blood equilibrium from an experimental to a mathematico-metaphysical basis feels that his predecessors and contemporaries, who have worked in this field by merely experimental methods, deserve little credit, if indeed he condescends even to mention them. He recognizes fully and properly the splendid contributions of Van Slyke. But toward Haldane (whose contributions from an experimental standpoint are really so immense that without him and his collaborators the subject of this book would scarcely have existed), the author at times uses a derogatory tone which violates the ethics of scholarly relations and which every one who has followed the development of this subject must condemn. Of one matter, which is almost the central point of the entire book, the author says (pages 80 and 81):

> To those who have not themselves experienced that state of bewilderment which is the usual condition of the investigator, it must seem strange that the physiologists who were studying the respiratory function of the blood should not have drawn . . . the conclusion that, since carbonic acid influences the oxygen equilibrium in blood, oxygen must influence the carbonic acid equilibrium. If proof of so obvious a condition is necessary a mere glance at the above equation will suffice. . . . Yet so little are physiologists accustomed to mathematics and such is the natural inertia of the mind, that this conclusion escaped us all and it remained for Christiansen, Douglas and Haldane to discover by experiment that the carbon dioxide dissociation curves of oxygenated and of reduced bloods are different.

Others do not think it so surprising that this discovery was made by Haldane and his collaborators.

The final evaluation of such a book as this must depend on whether it leads to further experimental advance or, on the contrary, encourages others to imitate its obscurity, its metaphysics and its condescension toward experimental workers, whom it further discourages by overloading the field with unnecessary technicalities. Certainly no worse example can be offered to those who in future should carry science forward than that of an eminent scientist and scholar preferring to impress his readers with his own profundity and erudition rather than to inform them by a clear simple and modest statement of the facts and theories of the subject.

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WORDS AND LIFE

To say the least, scientists are now being afforded a little amusement in the field of agronomic advance with respect to the creation and adoption of a suitable terminology. In spite of the humor and irony and sarcasm which appear ominously to be in the air in the discussions of the matter, there is a deep organic side perchance which sooner or later must be faced squarely. Love, language, life are no trivial playthings of scientists, but deep and vital moods of being, which are not easily subject to deliberately controlled extensions and prohibitions as one sees fit to make them. Language is no fixed entity but a facile thing, reflecting all the moods and modes of life. It begins with no group; it ends with no group. Words as we use them come from all the classes and castes among us, good or bad, and they perish or survive as the moods of the times would decree, oftentimes as the man of the street decrees. Men will not have words put into their mouths or taken out of them, only as they themselves will it. Years ago the writer left a little New England town to enter the doors of the University of North Carolina. In one of its English courses he wrote a theme using the word *swale* for a small meadow. It was thrown out unconditionally as a word not complying with the linguistic canons of *good use,* and he was given to understand a word must not be used which was not in present, national and reputable use. *Swale* withal is a good English word in New England, for a tiny meadow. It was suggested politely that the writer was provincial in his language. I still cling stubbornly to the good word swale for my tiny meadows, nevertheless, because it has a history, because it is a part of me, because I am more or less of an individualist and do not care to be standardized in every detail of my life by outside groups. We may easily invent new words but their universal adoption into the everyday English language is quite another matter. If the people wish them, they take them, good or bad, whatever their history, meaning, application, and no force of life will check them. As our language exists to-day, the agronomists, the botanists, the pathologists,