completely! (In this connection Richmond's[1] recommendation of a course in "scientific method" for all college students is one that should be considered most seriously). It is important also for a scientist to fulfil his teaching obligations completely. A teacher in science must constantly add to his personal store of knowledge new facts as they are made known. He must sift these carefully and give his students a sound foundation to which they can add the advancements that accrue in their lifetimes.

Third, a scientist has the obligation to indicate clearly to society what good he believes might be achieved from his contribution to knowledge. This is an obligation which should be taken seriously. Although he may not know fully the needs of society, he knows his work, and he should where possible take the first step towards the full utilization of his results.

It is possible that many would wish to modify these suggestions. It might be valuable to amplify and extend them. If, however, this discussion stimulates the reader to consider his relations to society and the obligations which they impose, the writing of this note will have been well justified. If, however, a scientist should acknowledge the three obligations listed here and conscientiously attempt to fulfil them, he is worthy of a respected place in society and his contributions will be lasting. After the scientist does his part, it is then the duty of those who guide society to see that means are available for the utilization of the achievements of science for the highest good.

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BIOLOGICAL TERMINOLOGY

AN additional point may be considered in the discussion of the college course in elementary biology.[1]

We may expect that the course will justify the effort required in installing and giving it, and that it will overcome the distrust of specialists and win a better place in the curriculum than that of a tolerated alternative. These hopes can scarcely be fulfilled, however, while many fundamental terms, common to all branches of biology, are used in distinctly different senses by specialists in the different branches. If the instructor in biology, being a zoologist, teaches these terms definitely in the senses to which he is accustomed, he imposes a handicap upon any of his students who may subsequently take up botany. This is the factual basis of the trite witticism that biology is botany taught by a zoologist.

[1] SCIENCE, 99: 2576, 385, 1944.

[1] The presentation of this course is defended in SCIENCE, volume 99 (1944), by G. Alexander, p. 78; L. J. Milne, p. 471; L. H. Taylor, p. 364; and M. B. Visscher, p. 383.

With diffidence, I submit the results of efforts to frame generally acceptable definitions for some of these terms. The results would be more recognizably authoritative if it could be shown that each term had been traced back through historical usage to original publication. Such is not the case. The definitions presented are based on much reading of text-books, on conversation and on experience in both ends of the classroom. In intention, at least, due weight has been given to original and current usage, to etymology and to the application of words to facts.

CELL AND PROTOPLAST

The word "cell" was brought into biological usage by Hooke, who designated by it minute cavities discovered by him in cork. Lamarck and Mirbel are said first to have formulated the principle that organisms consist entirely of cells and cell products. According to this principle, the cell may be defined as the unit of structure and function in organisms. In animal bodies, most of the units so described consist entirely of living substance. If, however, one defines the cell as the unit body of protoplasm, one comes into conflict with the basic meaning of the word, and with prior botanical usage which applies it to walled spaces from which the living substance has disappeared. The living unit is properly designated by a term ascribed to Hanstein:

A protoplast is a unit body of protoplasm.

The infallible mark of the individual protoplast is not the nucleus. It is the continuous differentiated living membrane called the plasma membrane or cell membrane.

A cell is a unit of structure and function in organisms, consisting of one protoplast together with any lifeless structures which may be attached to it, or of the lifeless remains of the same.

Thus the unit of the bodies of animals is at the same time a protoplast and a cell; the active unit in plants, containing a vacuole and possessing a cell wall outside the cell membrane, is a cell of which a protoplast is a part; a fiber of cotton is a cell from which the protoplast has disappeared.

RESPIRATION AND ENERGESIS

Forty years ago, the botanist Barnes, studying respiration according to the accepted botanical meaning of the term (which excludes breathing or gas exchange) consulted zoological literature and found out that breathing or gas exchange is precisely what it means. The zoological usage is justified by priority and etymology; Barnes coined the term "energesis" to replace it as it had been used in botany. That this term has not been in general use is an example of the perversity natural to man.

Energesis includes all metabolic processes by which energy is released. It occurs at all times in all living parts of all organisms.

Respiration includes all processes by which a gas necessary for energesis is taken into an organism, or by which a gas produced by energesis is expelled.

The relationship between respiration and energesis is that which exists between a draft and a fire. Respiration is generally but not universally associated with life. Photosynthesis, where it is proceeding at a perceptible rate, furnishes the one gas and removes the other by chemical processes taking place upon the spot; it makes respiration unnecessary.

MITOSIS AND CELL DIVISION

In most organisms, whenever the division of a nucleus approaches completion, the cell containing it begins to divide. Many biologists think of the division of the nucleus and that of the cell as inseparable, and apply the term mitosis to the entire process. There exist, however, a considerable number of examples of the separation of nuclear division and cell division. In cells of *Vaucheria* and *Rhizopus,* and in the endosperms of most seed plants, mitosis takes place repeatedly before any cell division occurs. Bacteria exhibit cell division in the absence of any process recognizable as mitosis. The term *karyokinesis,* construed as an exact synonym of mitosis, refers, etymologically, specifically to the nucleus. The following definition is perhaps tenable:

Mitosis or karyokinesis is nuclear division in the typical fashion, producing two nuclei of exactly the same genetic constitution (overlooking aberrations) as the original one.

The use of many other terms is open to discussion, but I forbear.

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THE POSSIBLE ROLE OF CHARA FRAGILIS IN MOSQUITO CONTROL

IN 1919 Caballero[1] in Spain published papers on the role of *Chara foetida* as a mosquito larvicide. In 1924 Barber[2] in the United States secured negative results with *Chara robinsii.* There has been considerable study of the subject, which was summed up in 1930 by Matheson,[3] who suggests that ingestion of oxygen bubbles given off by the plant may be injurious to mosquito larvae.

The writer has experimented with *Chara fragilis,* furnished by the botanical institute of Central University of Quito, and has used the five most common mosquito species of Ecuador. These are *Culex fatigans, Aedes aegypti, Aedes eupochamus, Anopheles albimanus* and *Anopheles pseudopunctipennis* var. *pseudopunctipennis.* Two of these species are malaria vectors, while one may carry yellow fever and dengue. Experiments with each of the five species were conducted in the same way, as follows:

(1) In an aquarium with growing *Chara fragilis* were placed 4 eggs; in another aquarium with hay infusion were placed 4 eggs. Normal hatching and development occurred in both.

(2) Four eggs were placed in a Chara infusion and compared with 4 in water. Normal development occurred in both.

(3) In the same way a water extract of fresh stems of Chara was compared with water, using 4 eggs in each for each species. Again development was normal in both media.

(4) Oospores of *Chara fragilis* were dried, crushed, mixed with yeast, and given to growing larvae of the first, second, third and fourth instars. These larvae developed normally, as did those in the check.

(5) Rotted stems of *Chara fragilis* were used in the same manner as the spore preparation, with the same results.

It may be noted that this Chara was found with other algae in pools where mosquitoes were breeding in nature. It was also noted that larvae ingested small particles of Chara, as Barber observed.

These experiments fail to indicate any pronounced controlling action of *Chara fragilis* against mosquitoes.

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[1] A. Caballero, *Bol. R. Soc. Esp. Hist. Nat.,* 19: 449–455, 1919.

[2] M. A. Barber, *Pub. Health Repts.,* Washington, 39(13): 611–615, 1924.

[3] R. Matheson, *Am. Nat.,* 64: 56–86, 1930.

SCIENTIFIC BOOKS

CLINICAL DIAGNOSIS

Clinical Diagnosis by Laboratory Examinations. By JOHN A. KOLMER. First edition, revised. xlii + 1247 pp. 78 figs. 137 tables. New York: D. Appleton-Century Company, Inc. 1944. $10.00.

THE material in this book is concerned primarily with two phases of the physician's contact with his patient; when he is trying to decide what laboratory examinations will aid in either diagnosis or prognosis and when he has received the laboratory report and