BOTANICAL LITERATURE FOR RUSSIA

THE world's war and the following events tore Russia away from the civilized world and stopped any access to its scientific literature. Now that normal relations between our country and its neighbors are being partly restored and the scientific literature of Western Europe begins little by little to penetrate into Russia, we are still deprived of North American publications. At the same time the financial conditions of our country are such that we are unable to purchase them from booksellers. This leads me in the name of the laboratory under my supervision to address botanists of the United States and to ask for help in our scientific work by sending copies of recent papers, books, etc. We shall be glad to send in return our publications.

CONST. MEYER

BOTANICAL GARDENS,
UNIVERSITY OF MOSCOW

SCIENTIFIC BOOKS

The Biology of Death. By RAYMOND PEARL. Philadelphia: Lippincott, 1922.

In many fields of scientific research, where progress is most active, the old barriers which have so long separated men of like mind and partitioned off congruous subjects are now disappearing. This fact is widely recognized in the case of physical chemistry, of general physiology, and of atomic physics. But there could be no better illustration of it than the new monograph on experimental biology, "The Biology of Death." Professor Pearl, an experimental biologist, has not found it necessary to change either his point of view or his methods of research in taking up his duties as professor of vital statistics, and in his first book dealing with the subject of his new chair he has drawn upon a wide variety of sciences, including cytology, pathology, genetics and statistics, without sacrifice of unity and with the happiest results.

The book opens with two questions: "Why do living things die?" "Why do living things die *when* they do." Pearl's answer to the first question may perhaps be stated as follows: Single cells, whether unicellular organisms, germ cells or somatic cells, die only by chance. All cells are potentially immortal. The proof of this statement is to be found in the work of Woodruff on *Paramecium,* of Jacques Loeb on artificial parthenogenesis and especially of Harrison, Leo Loeb and Carrel on tissue culture. Normal death in the metazoa is due to the wearing out of units of a higher order than cells, it is a result of the specialization of structure and function of the highly differentiated multicellular being.

It seems to me that this is probably a sound inference. Nothing could be plainer than the fact that death from valvular disease of the heart, or from cirrhosis of the liver, or perhaps from diabetes, corresponds with Pearl's statement. The conception also has the advantage of being analogous to our ordinary view of the wearing out of useful objects. Thus we wear out our boots or their soles, but the molecules of which they are composed remain unchanged. Indeed an aggregate of aggregates must be more unstable, in certain respects, than its component aggregates, for its existence depends upon the integrity of each component and of the relations between them. But it must be confessed that, until certain phenomena of senescence such as desiccation and the more conspicuous intracellular changes can be clearly accounted for, doubt will remain regarding the complete validity of any statement concerning this question, simply because we shall continue to feel uncertain of the exhaustiveness of our analysis.

In answering the second question Pearl turns to his own researches and classifies the causes of death "under the heads of the several organ systems of the body, the functional breakdown of which is the immediate or predominant cause of the cessation of life." A statistical treatment of the data, founded upon this classification, leads to the conclusion that the causes of death operate in a very orderly and regular manner, the biological significance of the regularities being, as a rule, not difficult to understand. Thus, in the first year of life the alimentary tract is to be charged with the greatest number of deaths, for the next fifty years of life it is the respiratory apparatus which takes first place, in old age the circulatory system.

From these facts the conclusion is drawn that advancement of the physiology, pathology and hygiene of the respiratory organs should

take a very high position in our effort to promote the health of the community and to lengthen human life.

Another and more compact biological classification of the causes of death depends upon the discrimination of the germ-layers from which the different organs arise. This yields the result that parts of endodermal origin are the most vulnerable (fifty-seven per cent.), those of ectodermal origin the least (about ten per cent.).

This subject is followed by a presentation of the evidence, first from statistics on men, then from Pearl's own interesting experimental studies of *Drosophila,* that length of life is inherited in a normal manner. Especially after an examination of these experimental data it is impossible to escape the conclusion that, other things being equal, duration of life follows the Mendelian laws, or the impression that further information and perhaps novel discoveries must result from the study of so unique a character.

But how far does environment modify the hereditary length of life in man? What is the accidental, what the preventable shortening of human life? To the analysis of this question much space is devoted. First comes the evidence that the expectation of life at birth in civilized communities has been increasing over a period of two thousand years. No doubt as a result of this fact, the expectation of life at advanced ages has meanwhile been growing less. It is difficult to see how these facts can be fully reconciled with another statement arising later from experimental evidence "that environmental circumstances [probably] play their part in determining the duration of life, largely, if not in principle entirely, by influencing the *rate* at which the vital patrimony is spent."

So far as the prospects of further great increases in the length of life are concerned, it is not surprising to find Pearl a moderate sceptic. Like yellow fever in the past, other diseases will no doubt be conquered by scientific methods in the future. Still others will be more and more restricted. But, on the other hand, it seems clear, according to Pearl, that some effects of preventive medicine are much over-estimated, partly through our ignorance of epidemiology, partly because of the sentimental enthusiasm of ignorant optimists. On the other hand, "the inherited length of life" definitely limits the progress that can be made through the agency of applied science. At this point the doubtful question seems to be how much progress can still be made before diminishing returns check further increase of effort. Pearl's opinion seems to be that long before the expectation of life at birth in the United States has been lengthened by thirteen years (a fair estimate of the effect of elimination of all preventable deaths) the law of diminishing returns must put an end to substantial progress. It is interesting, if only academically, to note that selection of long-lived stock, as in Pearl's *Drosophila* experiments, would rapidly lead to much greater results. These conclusions are reinforced by the fact that the death rate of the earliest period of life, and presumably of all periods, is selective. On the other hand those both of whose parents survive to the age of eighty live twenty years longer than those neither of whose parents reach the age of sixty.

This interesting book closes with the discussion of what is perhaps its most important contribution to the problem of population, the theoretical population curve of Pearl and Reed. This curve, which was developed from a simple hypothesis, has the formula

$$y = \frac{b}{e^{-ax} + c}$$

x being time and y population. It is a curve which also arises from the discussion of other natural phenomena and it fits the facts of population in a large number of independent cases with truly remarkable accuracy. With its help the discussion of the population of the United States leads to the conclusion that the *present* growth of population in this country is approaching a maximum of about 197,000,000 and that, unless some other new phenomena of growth or decay should be added, this maximum will be nearly reached in one hundred years.

A book so full of complex problems vigorously treated can not fail to arouse both interest and opposition. It is safe to say, however, that Professor Pearl has done an important work of scientific synthesis which must encourage and disseminate clear, critical, un-

sentimental thinking about one of the greatest of social problems.

L. J. HENDERSON

HARVARD UNIVERSITY

SPECIAL ARTICLES

OCCURRENCE OF HUMAN REMAINS WITH PLEISTOCENE FOSSILS, LAGOW SAND PIT, DALLAS, TEXAS

THE closing of the Lagow Sand Pit, Dallas, Texas, is a matter of regret to students of Pleistocene fossils in the southwest. This sand pit has been operated for seventeen years, excavating an area of about five acres. The pit is a part of a large featured terrace which follows the Trinity River for a number of miles. The top of the terrace is about fifty feet above the flood plain of the stream. The number of fossil finds has been large, though few of the finds have been saved. Of the fossils now preserved in the museum at Southern Methodist University, Dr. R. S. Lull has described seven species, with two new species and one new genus. Included in the list are a sabre-tooth tiger, deer, four-horned antelope, bison, camels, horse and mammoths. Since the closing of the pit makes it impossible that further knowledge will be gained from the locality, it seems a proper time to put on record the finding of a human skeleton associated with the Pleistocene fossils of the pit.

Section of Lagow Sand Pit

Top soil. Medium grained sandy loam, dark red to black.....2 ft.

Sandy clay, hard, tenacious. Red.....3 ft.

Fine sandy clay with light calcareous segregations and streaks. Texture of sand varies. Color yellow.

Fossils: Antelope, bison, mammoth, man .....2 ft., 10 in.

Fine to coarse clean white sand and gravel. Gravel usually under one inch. Cross-bedded. Forest beds not over 12 to 14 inches, usually 3 to 4 inches.

Fossils usually found at bottom, especially larger bones. Bones clean and usually white or cream in color. Mammoth, camel.....14 ft.

On October 26, 1920, I was notified by the owner of the pit that the workmen had uncovered bones which seemed to be human. Taking with me Dr. Robert T. Hill, I visited the pit, but found that the bones had been removed from the sand.

Referring to the above section, it is noted that only the lower part of the pit, the cross-bedded white sands, are commercially valuable. The upper layers constitute an over-burden. The over-burden is removed first. All of the workmen were agreed as to the location of the find—about five feet below the surface of the soil. There was no evidence along the wall of any disturbance or mixture of the different beds from bottom to top. Dr. Hill and I made close examination on this point. Mr. Lagow pointed out that there was no evidence of a grave having been dug, when it was suggested by a bystander that the man had been recently buried. The layers above the bones were well-marked stiff clays, and would apparently have shown any change or mixture with the beds below, such as would have been the case in digging a grave.

An examination of the sand and dirt found on the bones confirmed the statements of the pit men as to the exact position of the find. Mr. W. E. Wrather and Professor J. D. Boon, geologists, also visited the pit on the following day, likewise agreeing that there was no evidence of disturbance in the layers above the position of the human bones.

Only the one skeleton was found in the pit. No human implements or artifacts have been recovered. Dr. George Grant MacCurdy made the following report on the specimens:

The human bones from Dallas comprise segments of right and left femur, right and left tibia and right fibula; also the left horizontal ramus of the lower jaw and several fragments of the calotte. All presumably belong to one individual, a large adult male of the modern type. This is about all one could say without having in hand more of the skeleton.

A chemical analysis of the fossilized bones from the human skull and from the camel skull made by Miss May Whidsit, of Southern Methodist University, gives the following results:

Human:

P_2O_5 .....30%

CaO 57.8%

32.3%

Camel:

P_2O_5 .....31.5%

CaO .....55.4 %

31.04%

The degree of fossilization of the human skull and that of the camel are approximately the