

given clearly the characteristic high note, audible at considerable distance. But since it has been spread out in the warm dry room, and received some handling, it has lost the sonorous quality.

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#### MORE ON SINGING SANDS

TO THE EDITOR OF SCIENCE: The comment of Mr. Richardson in a recent number of SCIENCE (November 28, 1919) on the singing sands of Lake Michigan, calls to mind some observations made a number of years ago that should be considered in connection with the hypothesis he advances to explain the singing quality of the sand.

These sands were encountered by us in connection with the soil survey of Allegan county, Michigan. The singing quality was particularly well developed within four to six rods of the lake shore. We collected a sample of several hundred pounds which was forwarded to the Bureau of Soils at Washington. After the material was in the sack on the beach, the singing quality could be developed by merely running the fingers through the sands.

The material was shipped by freight and stored in the basement of the building then occupied by the bureau. Some months later the material was looked up and examined. It had completely lost its singing quality. Of course it had dried out. There was no leaching and presumably no change in chemical composition.

It has seemed to me that this quality is associated with two primary factors namely: (a) Very well rounded and smooth particles, (b) A particular amount and condition of moisture. Neither a very wet nor a very dry condition suffices. We have noticed a slight tendency to this singing quality in walking over the sand dunes in that section of Michigan, if the foot is jammed into the sand so as to get below the very dry surface layer and into contact with the somewhat moist sand immediately below.

I am inclined to think the percentage of

moisture when coupled with the smooth, rounded particles is the chief factor in developing singing sand. That per cent. is somewhere in the region of the lento-capillary point or the margin between hygroscopic and free capillary moisture where, due to surface attraction of the sand particle, film movement is very sluggish. It might be defined as the first stage of film solidification.

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#### THE INITIAL COURSE IN BIOLOGY

THE botanists are more and more loudly proclaiming their academic rights as against the zoologists. In most American universities now there is a course in general biology, and it is given, often entirely, by the department of zoology. It is a very large course, running sometimes to several hundred students a year. It involves a large staff, assistant professors, instructors and assistants, and thus provides places for graduate students without fellowships. Sometimes it carries more patronage than all the other courses in zoology, botany and related subjects combined.

Naturally the botanists feel aggrieved, when they compare the few students who reach their courses, and the inadequacy of the assistantships for their support in botany, with the opulent conditions in the department of zoology.

Professor George E. Nichols has presented recently in SCIENCE data bearing on this matter, and has discussed with fairness and ability the question of the initial course in biology. The initial course in any field is a difficult subject: whether it should be designed primarily as introductory for those who intend to go further, or as broadly educational for those who can not.

I take it as axiomatic that there is a certain minimum of information regarding matters biological which every educated man ought to have, and that this would consist particularly in some knowledge of the living human body. In fact, however, a large number of students are passing through our universities, many are even taking courses in biology, who fail

to obtain this minimum. I have known of engineering students who believed that the child is born through the umbilicus. I have sat opposite to an astronomer who refused to finish a glass of dark beer when he learned that in passing from his mouth and stomach to his kidneys the black and foaming fluid in the glass in front of him would have to go through his heart.

I am inclined to agree with Professor Nichols that general biology, as given by zoologists, is a course which is suited primarily to introduce students to animal morphology. But I doubt whether a course of this sort half as long, followed in February by an exactly similar course by botanists and introducing students equally to plant morphology, would be a better arrangement.

To my mind neither the zoologists nor the botanists should give the initial course, for if either or both have a hand in it, it will have the emphasis of a specialist. It will deal primarily with morphology plus a single function, that of reproduction.

The initial course should be a course in physiology. I may illustrate what I mean by speaking of zoologists as specialists, by quoting a distinction which I once heard a physicist give of the difference, as he saw it impartially, between zoology, or general biology, on the one hand, and physiology on the other. The former, he said, dealt with reproduction, the latter with all the other functions of life.

Now it is nice to know about amebæ and frogs and the germination of seeds, but a lawyer, or an engineer, or a journalist, or even a doctor, can get along and yet know very little of such matters. If, however, he has no notion of his own insides—of what purpose his food serves, and of why he keeps breathing—well, he simply is not an educated man.

Even for the student who is going far in zoology, or botany, I believe that the first great lesson should be in function, with structure included along with, but not emphasized above, chemical and physical basic facts.

The student should begin, therefore, in that field in which knowledge of function has been

most highly developed, a field which has the most powerful appeal for a human being, the field of "human," that is, mammalian, physiology as presented par excellence in that marvelous little book, Huxley's "Lessons in Elementary Physiology."

It seems—at least some of us hope—that today we are about to see a displacement of the academic college course in favor of a junior college, which would give such general subjects as the languages, American history, elementary chemistry and physics, and the one or two other things that every one should have; to be followed in the senior college by groups of increasingly specialized studies, each group aimed to a definite end. If this is to come, neither the course in general biology which Professor Nichols condemns, nor the combined elementary zoology-botany which he favors, is entitled to a place in the curriculum of the junior college.

But a brief course in human physiology is. At least, so thinks a physiologist.

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### SCIENTIFIC BOOKS

*The Fauna of the Clyde Sea Area*, being an attempt to record the zoological results obtained by the late Sir John Murray and his assistants on board S. Y. *Medusa* during the years 1884 to 1892. By JAMES CHUMLEY. Glasgow. Printed at the University Press. 1918. Pages vi + 200, 1 map and 3 figures in text.

The former secretary of the Challenger Office and of the Lake Survey of Scotland, Mr. James Chumley, for many years associated with the late oceanographer and marine zoologist, Sir John Murray, has compiled the data regarding the latter's explorations of the Clyde Sea Area in a "Fauna" of that region. The work has been financed by the Carnegie trustees for the universities of Scotland. The work contains brief account of the Scottish biological stations at Granton and Millport, which respectively preceded and succeeded the explorations which are here summarized.