

attractive. Geology has heretofore been mainly in the qualitative state. Its workers have been busy developing the processes involved and have had only the crudest means of elimination when it was necessary to test one hypothesis against another. As Van Hise has pointed out, we have now at least entered into the quantitative stage and this means nothing less than the reduction to an orderly basis of the accumulated observations of all the years past. As we accomplish this we shall change our science from an inexact one of hypothesis to an exact one of law; and we shall then stand on an equal basis as regards certainty with our associates of the physical and mathematical sciences. This is certainly a field large enough and important enough to attract the best energies of any man or woman. If our academy shall help to put the right man in touch with his problem and the means of solving it, we shall quickly justify its existence.

H. FOSTER BAIN

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OUTLOOK FOR YOUNG MEN IN PHYSICS

Mr. Chairman and Gentlemen: Sudden and unexpected as this call is, I feel bound by the courteous manner in which the invitation is extended to respond.

The opportunities offered by the science of physics may for convenience, at least, be grouped under the four following heads:

(1) *Research*.—To him who finds his "manifest destiny" in investigation, the recent discoveries of physical science have vastly multiplied the opportunities for new discoveries. To illustrate; when Hertz in the autumn of 1888 showed us how to produce electric waves, a tremendous field was opened to research. The various properties of waves of different lengths under different conditions all had to be studied. Every year some new do-

main of this kind is made ready for occupation by the earnest and serious student.

(2) *Applied Physics*.—For him who has that practical turn of mind which characterized Franklin and has yet preserved an interest in pure science (which also characterized Franklin) there is always a rare opportunity. In the autumn of 1831 Faraday not only discovered the induction of electric currents, but also actually made an electric motor and an electric generator about the same time. But it was not until the late sixties that the dynamo became a commercial success. This delay is typical of the mental hysteresis which generally separates discoveries in physical science from their industrial applications.

It was seven years after Hertz's discovery of electric waves before Marconi showed them to have commercial value; and it has taken practically twenty years to employ them for transatlantic messages. In these intervening periods lies great opportunity for the alert "practical mind."

(3) *Engineering*.—Nearly all the great engineering concerns of America are looking for more men than they can find of the broadly trained type—men who are acquainted, *at first hand*, with the general principles of physical science. A man may know every machine in the shop of an engineering firm and yet not know how to design a new mechanism to meet a new want or a new circumstance. What is demanded to-day is, therefore, not so much an acquaintance with present-day practise as a thorough mastery of the fundamental principles of engineering—and these are mainly the principles of physics.

(4) *Teaching*.—The high salaries which engineering concerns are offering to men well trained in physical science and to men of executive ability have had the effect of leaving vacant many excellent teaching positions in physics. The door is wide

open for him who enjoys this line of work and who is willing to leave behind all hope of opulence.

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OUTLOOK FOR YOUNG MEN IN ZOOLOGY

IN the ten minutes allotted, I shall attempt to answer six questions of special interest to those who are planning to enter zoology as a profession. Through the kindness of Professors Mark, Minot, Comstock, Sedgwick, Reighard, Lillie, Conklin, Ward and Jennings, who have generously responded to my appeal for information, I am in a position to state the outlook for young men somewhat from the standpoint of their experience. As far as possible, the answers to the questions relating to the topic assigned me will be given in the words of the above-named zoologists.

1. *How do the chances for getting good positions compare with those of a decade ago?*

All of the zoologists who have expressed an opinion on this question agree that the chances are much better than they were a decade ago. Professor Comstock writes: "I should say that they are much better. It is only fair to emphasize, however, that the man who takes up work along these lines purely as a financial venture, apart from other considerations, will be disappointed. And I should say also that a large part of the demand for entomologists in recent years has been due largely to the great increase of this kind of work in the Department of Agriculture at Washington. Many men have found places with Dr. Howard or have taken places vacated by others who have gone to Dr. Howard. If the government support of this kind of work were to cease it would make a great difference in the chances for getting good positions."

Dr. Mark writes: "Have been surprised

that the demand has increased so rapidly. This has been more noticeable in the field of comparative anatomy than in other lines during the past five or ten years."

According to Dr. Minot, "There is great difficulty in getting any men for positions in anatomical and zoological laboratories, and I believe that for a few years the opportunities will be unusually good. But for heaven's sake, do not encourage any mediocrities to go into science. If you can, have them Oslerized at sixteen."

Dr. Conklin thinks that the chances of a young man's going at once from his graduation to the headship of a department are probably not so great now "as they were a decade ago."

Dr. Jennings says that "it is difficult to get the men needed for positions in zoology, and this is true all along the line from assistantships up to full professorships."

2. *Is it ever necessary for a man with a doctor's degree to rest on his oars for a year because no desirable college or university position is open to him?*

The reply of Dr. Lillie is typical of the answers given to this question: "In the course of a good many years several of our doctors of philosophy have accepted positions in high schools and normal schools; in such cases it has usually been a matter of preference with them. So far as I know, there has never been a case of one of our doctors of philosophy being obliged to go without a position for even a year."

According to Dr. Jennings, "many excellent positions have gone to men without the doctorate."

3. *Does the number of desirable positions equal the number of candidates?*

Dean Ward writes that "there have been more desirable positions in zoology which have come to my attention in the last five years than I could have filled three times over if every one of my advanced students