

cient for the next. We earnestly hope that any appeal that may be made for funds to improve this Department of Zoology may meet with the generous response it certainly deserves.

EDWIN S. GOODRICH

THE SPIRIT OF RESEARCH

THE recent World War emphasized the importance of scientific investigation and as a result there has followed a vigorous campaign to promote research in America. In consequence a great deal has been published recently concerning the *mechanism* of research; how we may cooperate; how the large university with superior equipment may help the teacher in the small institution to keep alive the hope that is within him to do research work; we have bulletins issued from time to time which bring certain fields of knowledge up-to-date; we have compendia on the technique of research; in a host of different ways the machinery for doing research is being cleaned and oiled and must run infinitely better than it has in the past. This is all exceedingly important and must be done if we are to take a share in the program of scientific investigation. Back of all this machinery, however, must be human minds and the progress we make in the search for truth is going to depend on the *spirit* which animates these human minds guiding this machinery of research and taking part in the actual investigation of the many unsolved problems about us and trying to

Read the world's old riddles well.

In other words, the motives which prompt men to spend long hours and sleepless nights trying to fathom the depths of the unknown will determine the success individuals have in their work.

As one goes over the records of human achievements in history, there is developed in the reader a sense that the great achievements of the world have been in the realm of the spiritual. (Using that term in its broadest meaning.) The Magna Charta, the advent of the Pilgrim Fathers, the Boston

Tea Party, the Declaration of Independence, the Emancipation Proclamation are events and articles having the greatest spiritual significance. Great because they were staged for the uplift of the masses and not for the aggrandizement of the few as the failures of Alexander, Napoleon and William the Second are glaring examples.

It would seem that lessons of immense value to us might be gleaned from history as an aid in stimulating the spirit of research. What have the ancients to offer us? If achievement comes by means of spiritual forces then the animus of research must be spiritualized. Too much have we strayed from the simplicity of spirit which ruled the mind of the savant on the isle of Penikese who had

come in search of truth
Trying with uncertain key
Door by door of mystery.

Too much have we been stimulated by personal ambition in our "search for truth." Promotion, because of the amount of research we do is not the spiritualization sought for in this plea. The fundamental virtue of the investigator is a passion for truth whatever it be and through whatever channels it may come. As Bosworth says,

One's only safety consists in a fair treatment of facts. One fact fairly treated leads to another, and this to another. Facts treated as they ought to be treated lead always to a larger life.

This means not only a larger life for the investigator but more particularly for the great human family about him. Imbued with this spirit the seeker after truth goes in its search with the altruistic ambition of making the world a better place to live in, in every sense of the word "making it safe for democracy."

Not of the sunlight,
Not of the moonlight,
Not of the starlight!
O young Mariner,
Down to the haven
Call your companions,
Launch your vessel,
And crowd your canvas,
And, e'er it vanishes

Over the margin,
After it, follow it,
Follow the gleam.

There is a grave danger for the spirit of research when the chief criterion for the advancement of an individual in his position is his ability to turn out voluminous material describing his experiments. This motive prompting the researcher tends more and more to satisfy personal ambition. There will gradually appear a greater amount of polemical writing and controversies over priority of discovery. Nor is this all or the worst of the results attained by such a stimulus to research. Inaccuracies and carelessness in obtaining results are inevitable, it is the logical outcome of a system where bulk and not quality weighs so heavily in seeking promotion. This tendency we are all aware of, not only in individuals but we recognize it as characteristic of nations as well. After all what difference does it make through whom truth is revealed if all can enjoy its fruits?

On the other hand, that land whose cricket and other sports have imbued its citizens with a sense of the "sport for the game's sake" has contributed a succession of epoch makers in the field of science that makes one wonder whence the inspiration of it all. One can not imagine the immortal Newton worrying very much about the status of his position because the first computation concerning the force of gravity due to the earth at the moon did not yield results as he had anticipated. To him and a great host of his fellow countrymen succeeding him it was sufficient to seek first the kingdom of truth, leaving it to others to judge whether the honors of earth, if they had any value, would be added as a natural result of ability. Is it not worth while for us of America, young in the research field, to consider seriously the motives which are to prompt our endeavors in the search for truth? The first motive leads to mediocre results while the latter is characterized by those discoveries which are epoch making. Shall personal ambition or the desire to be "a friend to man" surge

through our endeavors? One class who followed the gleam of truth was hypocritical, men who seemed to have, and wished to seem to have the prestige of scientific distinction without actually possessing it. The other class adopted as their ideal those words which must be the true sentiment of every creative worker in every field of human knowledge:

And only the Master shall praise us, and only the Master shall blame;
And no one shall work for money, and no one shall work for fame;
But each for the joy of working, and each, in his separate star,
Shall draw the Thing as he sees It for the God of Things as they are."

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THE CONCENTRATION OF HYDROGEN IONS IN THE SOIL

A PAPER with the above title has been published in Danish in the reports from the Carlsberg Laboratory (*Meddelelser fra Carlsberg Laboratoriet*), Vol. 15, Nr. 1. An English edition of this paper will soon be published in *Comptes-Rendus des Travaux du Laboratoire Carlsberg*, Vol. 15, Nr. 1.

The paper contains an account of researches carried on during the years 1916 and 1920 in order to ascertain the importance of the concentration of hydrogen ions with regard to the natural distribution of plants. Analyses were made of a series of Danish plant formations with regard to their botanical constitution, and at the same time samples of the soil were taken from the places in question, and the concentration of hydrogen ions determined. In natural Danish soil it was found to vary from 3.4 to 8.0 as expressed in pH values.

When comparing the botanical analysis of the formations with the physico-chemical analysis of the soil it was immediately seen that there is rather a fixed and constant relationship between the constitution of the vegetation and the concentration of hydrogen ions in the soil, because important variations of the latter are always accompanied by vari-