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ADVENTURE, ROMANCE AND SCIENCE[1]

MAN has struggled up a long trail from the past, leaving many competitors extinct along the way, and stands on the high peak of civilization that we enjoy to-day. Even in the old stone age there was plenty of adventure, with perhaps a little romance now and then—yes, and science, too. From the glimpses that ancient documents give into what went on in times long before they were written, and from conditions that obtain among primitive peoples to-day, it seems probable that there have always been scientists among men. These scientists were, and are, peculiar personalities that wanted to know about things. Even to-day they are often looked upon by many of their companions as men of "authority" and at times treated with respect.

In his life cycle every man roughly recapitulates the past, and (alas!) probably the future, history of the human race. This recapitulation is apparent in many ways, but, as civilized man is judged chiefly by his mind, the present discussion will be confined to mental qualities. A child sucks, feels and views his little world with wonder and admiration; thrills with new sensations—gaining in experience day by day. After a time he finds that he knows something, and becomes a delighted critic of his father's table manners and his little sister's English. Approaching maturity, he wants to do something—just what is uncertain—but something must be done. Man has an instinctive urge for a place in the world. Then the golden age comes—the man finds out what the greatest thing in the world is and begins his life work. He trains and works and looks for responsibility and plans, and—if Fortune smiles—may meet with success. After a life spent in labor, the man finds that he is not as important as he thought in the beginning. Then he takes a little time off now and then to enjoy himself, and sometimes develops a certain degree of toleration for others who are trying to live a life. Finally, man spends his old age feeling more or less apologetic for living at all. But hope never seems to die in the human breast and the old man, though left behind by the next generation and in his soul convinced of his perfect uselessness, does not despair. In fact, he gets considerable satisfaction by telling the rising generation about what he claims is a grand life

[1] Presidential address before the Wisconsin Chapter of Sigma Xi, May 2, 1923.

that he has lived, but what is really such a life as he hopes some of his patient advisees will try to live. Thus the cycle goes round.

The army intelligence tests made it apparent to all the world that there are many eccentrics in the cycle of life. Some personalities are arrested in youth. Every one has known persons who went through their lives thrillfully suckling, handling or viewing each experience—and then waiting for something else. These poor souls of course never attain a place in the world. Others miss their place because they do not earn it, but have a pseudo-place given them by Fortune, and they therefore skip from youth to the enjoyment of the pleasures that normally come after the struggles associated with maturity. Some limited personalities are obliged to begin what should be their maturity with the apologies of old age.

It is indeed fitting that after all these ages and chances for failure we should be felicitated on being here to-night—mature, more or less sane personalities; most of us just beginning careers as scientists. We have every reason to feel proud of the human race for its successful domination of the earth and we may rejoice that we of all the people are the personalities endowed with the appropriate qualities to take up work in the greatest field for human endeavor—science.

I might speak to you in an inspiring way concerning our duty to cooperate or discuss the value of science or the grandeur of research. I have talked the matter over with my wife and she assures me that I am enough of a hypocrite to do any of these things well. Better still, and easier, I might by appropriate arguments show what is wrong with science or religion and point out how we might all live better and more scientific lives. However, I am not going to do any of these things, but only make a few more or less irrelevant remarks concerning science and scientists.

President E. A. Birge in a recent address maintained that there are two types of scientists: (1) those who want to know about the world, and (2) those who want to make the world serve them, Darwin and Pasteur being cited as examples of their respective classes. In my opinion there are at least two other classes of persons that call themselves scientists: (3) politicians, and (4) those who are having a good time. All these classes, with the possible exception of the last, furnish their quota of men who are an honor to science. The inquisitive individuals with unquenchable thirsts for knowledge make most of the discoveries; the practical minds make nature an increasingly valuable servant of man; the politicians hold the offices in scientific societies, appoint the fellows and exercise other power-satisfying functions; the joy-riders of science have a good time. My remarks to-night will be primarily to and for the last class. What opportunities does science offer for enjoying life?

In his delightful work on "The Pleasures of Life" Lubbock says,

> "the world would be better and brighter if our teachers would dwell on the Duty of Happiness as well as on the Happiness of Duty; for we ought to be as cheerful as we can, if only because to be happy ourselves, is a most effective contribution to the happiness of others."

The words of such an authority leave no doubt that happiness is both altruistic and scientific. But there are of course various kinds of pleasures, and scientists are undoubtedly worthy of the best. Of all the thrills that man may feel, there are none that have the glamor of adventure and romance.

There are many who feel that Don Quixote, Captain Kidd, Pizarro and other well-known adventurers had all the adventures worth having and that in this modern, do-it-with-electricity and say-it-with-flowers world there are no adventures left that are worth having. There is also a feeling that romance ended with the passing of crusades or that romance is associated with the shinning of fair maids down knotted bed sheets into the arms of poor but worthy lovers, and that Douglas Fairbanks has it syndicated. To convince such doubtful spirits let me quote from the letter that Ross wrote from India after his long struggle to prove that the mosquito transmitted malaria.[2]

> "But now, in order to ensure at least definite negative results, redoubled care was taken; almost every cell was examined, even the integument and the legs were not neglected; the evacuations of the insects found in bottles, and the contents of the intestine were scrupulously searched; at the end of the first examination staining reagents were often run through the preparation and it was searched again with care. The work, which was continued from 8 A. M. to 3 or 4 P. M. with a short interval for breakfast,[3] was most exhausting and so blinding that I could scarcely see afterwards, and the difficulty was increased by the fact that my microscope was almost worn out, the screws being rusted with sweat from my hands and forehead, and my only remaining eyepiece being cracked, while swarms of flies persecuted me at their pleasure as I sat with both hands engaged at the instrument. As the year had been almost rainless (it was the first year of plague and famine) the heat was almost intolerable, and a punkah could not be used for fear of injuring the delicate dissections. Fortunately my invaluable oil-immersion object glass remained good.
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> "Toward the middle of August I had exhaustively searched numerous grey mosquitos, and a few brindled ones. The results were absolutely negative; the insects

[2] Boyce, R. W. 1910. "Mosquito or Man?" London, xvi + 280.

[3] In the tropics "coffee" is served in the morning and "breakfast" about noon.

contained nothing whatever. . . . On August 20 I had two remaining insects, both living. Both had been fed on the 16th instant. I had much work to do with other mosquitos, and was not able to attend to these until late in the afternoon, when my sight had become very fatigued. The seventh dappled-winged mosquito was then successfully dissected. Every cell was searched and to my intense disappointment nothing whatever was found, until I came to the insect's stomach. Here, however, just as I was about to abandon the examination, I saw a very delicate circular cell, apparently lying amongst the ordinary cells of the organ, and scarcely distinguishable from them. Almost instinctively I felt that here was something new. On looking further, another and another and another similar object presented itself. I now focused the lens carefully on one of these, and found that it contained a few minute granules of some black substance, exactly like the pigment of the parasite of malaria. I counted altogether twelve of these cells in the insect, but was so tired with work, and had been so often disappointed before, that I did not at the moment recognize the value of the observation. After mounting the specimen I went home and slept for nearly an hour. On waking, my first thought was that the problem was solved, and so it was.

"The mind long engaged with a single problem often acquires a kind of prophetic insight, apparently stronger than reason, which tells the truth, though the actual arguments may look feeble enough when put upon paper. Such an insight is mainly based, I suppose, on a concentration of small probabilities, each of which may have little weight in itself; but in this case, at all events, the insight was there, and spoke the truth."

Oh, boy! Is this adventure? Is this romance?

My friend, Professor H. C. Cowles, recently had an enjoyable experience. Years ago, Cowles had a lot of fun determining what relation the growth rings in tree trunks and the general shape of trees had to wet and dry ground and to rain and drought. Recently the United States sued some lumbermen in Arkansas for cutting timber that did not belong to them. In court the culprits claimed that they had acquired rights by the purchase of claims from early settlers, who had lived on the shore of a lake that dried up about 1840. The whole case hinged on whether there had been a lake or not. Well, Cowles went down there and proved scientifically and conclusively, using cypress trees and stumps as evidence, that there had not been any lake present for at least 150 years. The government got its money all right and incidentally (just to make the joke complete) Cowles got his. If there is any man on earth who has a good time, it is Cowles.

The young man in science says: What are my opportunities? What can science do for me? It is my privilege to point out to him that scientists are a picked, unusual, privileged lot of people, who are much superior and enjoy superior opportunities to those in any other walk in life.

For example, the broker comes home at night and says:

"Friend wife, the lambs have been swarming this week and I brought home a couple of pearl necklaces. If you do not want them just take them back to Spiffany's and exchange them for something else."

"Thank you so much," says the wife.

The scientist returns to his joyful home and says:

"My dear, I have received notice that the Finnish Society for the Discovery of Paleolithic Artefacts has elected me to honorary membership."

"Is that not fine? I am so proud!" says the wife. "I have had a pleasant day, too. I am making over my wedding gown and it is going to look real nice. By the way, John's shoes are all worn out."[4]

A prominent scientist has recently published a spirited resentment and disgustatory against American men of science.[5] This man can not sleep because scientists do not demand and get the money that they really earn. He claims that scientists really contribute all the big ideas to commerce and get little or nothing in return. In fact scientists are often actually obliged to beg for a little money in order to enjoy themselves doing research. This writer has, I feel, missed the point of science. The basis for all *social* procedure is *custom,* and while a man goes into science to make discoveries, help his fellows, manage other scientists or even to have a good time, he *never* goes into science to make money. It is not done; that's all. If a scientist tried to do such a thing, he would of course be "impure." To be sure, a scientist can not be blamed if he incidentally does earn a little money through no fault of his own, but to start out maliciously to do it is scandalous. As a reward for going without money, scientists enjoy peculiar social privileges that are more or less associated with the fact that they are not concerned primarily with making a modest or a magnificent living, but with the increase of knowledge. The opportunity to think free thoughts, to know and discover are worth more than money to a scientist.

Now, I feel that I ought to admonish the young scientists that they, being of the elect of the earth, should be dignified and moderate in all things. They should in any and all joyful pursuits of course have a good time, but also remember that there are persons in the world who wish to be treated with respect and many who wish to sleep. A young Californian hurt the feelings of a lot of thoroughly scientific geneticists by crassly improving a considerable number of plants in order to help out some common horticultural

[4] There is more of this dialogue, but, as much of it has no direct bearing on science, I do not quote in full, feeling that enough has been rendered to give the "atmosphere" which is more or less familiar to scientists.

[5] *Sci. Mo.,* 14: 567–577.

friends of his. A scientist in New York has not only grossly offended a number of his colleagues by refusing to accept certain good old traditions, but during one of his joyrides actually threw mud at the image of God. Such unnecessary occurrences are of course regretted by all, and should be avoided because they are likely to give science a bad name.

Witmer[6] says: "Intelligence is the ability to solve new problems . . . Education is the device of civilization to keep from encountering new problems." A scientist lives largely on ideas. The late John O. Reed once said of one of his colleagues: "I do not particularly mind him, because I know that he really does not think. He only thinks that he thinks." Any one who reads scientific journals soon learns that a certain proportion of the scientific world belongs in the same class with Dean Reed's friend. But, after all, one of the fine things about the scientific attitude of mind is that those who have it think what they please, without fear or prejudice or self-interest. Facts are facts. They require no apologies. Scientific spirit is bound at times to lead those who possess it into conflict with authority and established institutions. But it can not be suppressed. Science is always right because it seeks only for truth, and truth hurts no one. Unfortunately, scientists are not always right.

A scientist has his circulating medium in problems. He deals in and develops problems as a broker deals in stocks and bonds. When his problems are completed he "sells" them to the scientific world by publication, usually at his own expense. For a scientist there is no joy like that of working in his chosen field. Holmes said: "What have we to do with time but fill it up with labor?" To work, to know, to discover and create—for a scientist there is nothing beyond this!

A "real" or "pure" scientist can have little pleasure from life if he begins his career by craftily seeking out the best "field" or "opportunity." Modern genetics tells us that we are preordained to be osteocephs or geniuses. If one works and worries day and night for forty years on what he loves most, he may amount to something, and he may not. Genetics alone knows and it won't tell. At least we can enjoy ourselves. The greatest thing any man can do for science is to respect himself, love his work—and keep working. I wish you scientists a long and happy life—adventurous and romantic.

A. S. PEARSE

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[6] *Sci. Mo.*, 15: 57.

THE MAINTENANCE OF ORGANIC MATTER IN SOILS

NONE of the hypotheses for the origin of the earth make any provision for the presence of combined nitrogen in the lithosphere. All productive soils, however, contain this element in some form generally closely related to the organic matter present, and nitrogen is one of the plant food elements essential to the development of all higher forms of plant life. The atmosphere must, therefore, be the primary source of all soil nitrogen, and its incorporation in the soil is dependent upon precipitation, free fixation and the fixation power of legumes. Such incorporation has had an opportunity to continue for long geological periods with the result that there has been a gradual accumulation. Under conditions where there have been no losses through leaching, this accumulation is not only directly proportional to the precipitation received, but naturally also to the amount of vegetative growth produced on the soil. The tendency has been in nature to convert this nitrogen into an organic form and it is in this form that practically all of the soil nitrogen exists. Results from various soil investigators working in widely different climatic sections have shown that the ratio between the nitrogen and the organic matter and also between the carbon and the organic matter is practically a constant. This constancy is so well established by experimental data that the approved methods for determining soil organic matter are based on the carbon and nitrogen content of the soil.

$$\text{Organic matter} = \text{Carbon} \times 1.724$$
$$\text{or Organic matter} = \text{Carbon dioxide} \times .471$$
$$\text{or Organic matter} = \text{Nitrogen} \times 20$$
$$\text{then } \frac{\text{carbon}}{\text{nitrogen}} = \frac{20}{1.724}$$
$$\text{or Nitrogen : Carbon :: } 1 : 11.6$$

This ratio of practically 1:12 is established by nature at a point where it has a very pronounced relationship to productivity. It is found that where organic matter composed largely of low nitrogen-carrying material is applied to a soil, nitrate accumulation is inhibited to the extent that crop development is retarded. This effect on nitrate accumulation is felt until sufficient carbon has been eliminated as carbon dioxide in the process of decomposition to establish a nitrogen-carbon ratio of about 1:12 in the remaining material.

Under natural conditions where no special effort is made to encourage nitrification and where all vegetative growth reverts to the soil, plant development