In J. W. Mellor's monumental book, Vol. V, p. 720 (1924), it is stated: "Boart and carbonado are usually regarded as forms intermediate between diamond and graphite." But the photographs indicate that the crystalline form throughout is that of diamond, the differences in hardness being primarily consequent on variations in the structure and particle size of the aggregates.

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BACTERIAL STEM-ROT DISEASE OF HYBRID SEEDLING CANES

IN October, 1930, a bacterial stem-rot disease of hybrid seedlings canes appeared sporadically in the cane culture of the College of Agriculture at Los Baños, Laguna, Philippine Islands. Later the same disease was observed on hybrid canes in the sugar cane plantation of the Calamba Sugar State at Canlubang, Laguna, and in the sugar cane plantation of the Pampanga Sugar Development Company at Del Carmen, Pampanga. Affected plants show pale yellow color on the foliage followed by wilting of the entire plant. When weather conditions favor, the tops of the diseased plants fall over as a result of the rotting of the tender tissues of the shoot.

Microscopic examination of diseased plants showed the presence of abundant motile bacteria between the cells in the young stages and within the cells in advanced stages. The vascular tissues are apparently free from the bacterial invasion.

The bacterium has been isolated and grown in pure culture. Inoculation of healthy plants with the pure culture of the bacterium reproduced the disease. The organism is of the genus *Bacillus* Cohn., since peritrichiate flagella are demonstrated by proper staining methods. The causal bacterium is a cylindrical rod with more or less rounded ends. The cells occur singly or in pairs, occasionally in chains, and in clumps in 24 to 48-hour-old culture. Films prepared from the juice of infected canes and stained with aniline gentian violet gave measurements of the cells from 0.95 to 2.2 by 0.5 to 0.7 μ. Spores are not formed. Thin capsules are formed in three-day-old nutrient agar slants. The cells are motile by means of peritrichic flagella numbering from four to several. No involution forms were observed in one-month-old fluid cultures. The bacterium is gram negative and non-acid fast. No such species of bacteria has been reported heretofore as the cause of a stem rot of sugar cane. A more detailed description of the disease and the bacillus is in preparation.

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THE FOUCAULT EXPERIMENT

IN connection with certain studies related to the relativity theory it has occurred to the writer that it might be interesting to repeat the famous Foucault pendulum experiment on a large scale, over a long period of time of perhaps a year or more, and under carefully prepared conditions.

To do so would, of course, require a suitable place and the solution of a number of problems associated with its construction, continuing its motion without affecting its direction, precision of measurement, and others which occur with contemplation. With a pendulum length of 100 feet, for example, rotational motion with a period of more than 2,000 years should be easily detectable over a length of time of a year.

This experiment, if thus carefully performed might reveal or disprove some very intriguing speculative possibilities. It is rather fruitless to outline them but it would seem that a plane of motion for the pendulum perpendicular to the direction of the sun at the earth's perihelion would be a good place to start.

The writer is seriously considering undertaking the task and would be much interested to see opinion, criticism, or suggestion.

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SCIENTIFIC BOOKS

A History of Applied Entomology (Somewhat Anecdotal). By L. O. HOWARD. Smithsonian Miscellaneous Collections, vol. 84. Washington: Nov. 29, 1930. 564 pp., 51 plates (portraits).

> For the fly, the fly, the fly is on the turmit,
> And it's all me eye, for we to try
> To get fly off the turmit.—*Old Oxfordshire Ballad.*

The intelligence of the human race, *if brought to bear*, will conquer the insect menace.—*L. O. Howard*, 1930.

IT is probably no exaggeration to say that many thousands of people, at the present time, owe their lives to the work of the entomologists. The greatly increased population of nearly all civilized countries could not be supported without a correspondingly increased food supply, and this we owe in large part to those who have taught us how to defend ourselves against the attacks of insects. Thus, to give a concrete example, there is no orange-grower in California who doubts that his crop would be entirely ruined, were it left to the insects which prey upon it. Within a few years, at most, he would have to go out of busi-

ness, and a product worth about a hundred million dollars a year would have practically ceased to exist. In the discussions concerning the Mediterranean fruit fly, it has not been clearly brought out, but is undoubtedly a fact that it would pay California to spend a million dollars to keep that insect out one year. Not only the enormously increased acreage under cultivation, but the spread of injurious insects from one country to another and the frequent absence of their natural enemies have favored the inordinate increase of many kinds of insects which were formerly harmless. New situations are continually arising in various parts of the world which threaten the prosperity and even the livelihood of whole populations. Not only are the crops attacked, but man and his domestic animals suffer from many diseases which are transmitted through the agency of insects. Malaria, bubonic plague, sleeping sickness, typhus and yellow fever are all transmitted through the bites of insects. Even in warfare it has often been found that insects were the principal enemies, more destructive than the bullets of the opposing army.

I am old enough to remember very well the discoveries of the mode of transmission of malaria and yellow fever, the arrival in America of many pests now prominent, the constantly increasing dangers from insect attack, and the development of means for resistance. As I think of it, we have suffered much from our ignorance and incapacity, from our unwillingness to learn and our lack of organization and cooperation. Yet after all great progress has been made, and the development of the subject, in all its ramifications, is sufficient to amaze those who understand it. Whatever our errors and faults, it still remains true that the work of the entomologists has made possible the existence of great numbers of people for whom, otherwise, there would have been no sustenance, or who would have perished from disease. I said above, many thousands, but doubtless many millions are involved. But in matters of this sort mere statistics are wholly inadequate.

Such a movement, having such great results, deserves to be recorded as history. The ordinary historians know nothing of it, nor are they competent to deal with it had they the wish. Few there are, indeed, who can view it in a comprehensive and intelligent way, and describe it interestingly. Of all men, it was obvious that Dr. L. O. Howard was the best fitted for this undertaking. We may rejoice that his retirement from executive duties has not meant idleness, but fruitful work, the first product of which has just been published by the Smithsonian. It is a history and description of economic entomology, based primarily on the knowledge and experience gained through many years of service: but also, when necessary, compiled from many sources, published and unpublished. It is not, indeed, a perfectly balanced history of the subject, such as may some day be written, because it deals especially with matters familiar to the author. Yet no man has had such wide experience, abroad as well as in America, and nothing could be more appropriate than the description of this experience for us and posterity. Through it, we get the best possible understanding of the essential facts, just as we understand a country better from the well written account of a traveller who has passed through it, than from a portly volume of data on topographical features, populations, trade statistics and the like.

The first part (198 pp.) deals with applied entomology in North America. The second part (138 pp.) describes the work in Europe. Other sections relate to Asia, Africa, Australasia and the Pacific, South and Central America and the West Indies, and medical entomology. The extremely interesting series of portraits includes European celebrities of the seventeenth and eighteenth centuries, fifty-five United States entomologists (three of them women), five from Canada, five from Mexico, and many from other countries. Plate 39 shows five men who are working or have worked in the Hawaiian Islands. In his treatment of the United States, Howard omits the portraits of all the younger men, and very many of them are not even mentioned. He also gives little information concerning the work of many of the experiment stations and other local institutions. On the other hand, the data concerning foreign countries are as complete as it was practicable to make them, and the work of the younger generation is very fully described. Due apologies are made for this onesidedness, and we can readily understand that it was impossible to fully describe all the work going on in different parts of North America without spending additional years and producing another large volume. We in this country may well feel grateful for so much concerning men and measures abroad; but there is a certain danger, very frankly recognized by the author, that foreigners may not adequately appreciate the work of the United States. Thus such books as the "History of Entomology in California," which is being written by Professor Essig, will have their appropriate and very useful place.

In another respect we notice a certain lack of balance, which we have little inclination to criticize adversely. In discussing the events of the past century, and men who have long ago departed from the stage, good and evil are set forth with sufficient frankness to bring out the difficulties and conflicting purposes which so often hindered progress. This was necessary in the interests of historical accuracy, and seems in no case to suggest malice. The very serious faults of C.

V. Riley, Howard's predecessor in office, were well known to all the older men now living, but here they are first clearly described in print. At the same time, no less clearly and emphatically, we are told of the really great things accomplished by Riley, so that when all is said we must recognize him as a potent factor in the development of modern economic entomology. He was the victim of a peculiar temperament, and of political influences which surrounded him, but he had his vision, and was a man of outstanding ability and sagacity. In all these matters, we are inclined to compare him (except as to the politics) with another great naturalist, E. D. Cope.

But to come back to the alleged lack of balance; it consists in this, that whereas long past events are frankly described, all care is taken to avoid hurting the feelings of those now living. Thus the unsophisticated reader might imagine that whereas in the past there was the devil to pay, now virtue, industry and intelligence reign supreme. Who can regret this reticence? Any other course would have been impossible, though I must confess that there are some optimistic passages which I should have omitted. As a matter of fact, while we still have to regret some of the attributes of *Homo sapiens,* it is perfectly true that on the whole the face of things has vastly improved. For one thing, good traditions have been established, which will not readily be broken. Thus heads of departments do not, to-day, coolly appropriate without acknowledgment the work of those under them. Often the tendency is all the other way, and subordinates or students are allowed to publish work which owes its inspiration and much of its originality to those directing them. Crass political influence is not so rampant as it was, and as a rule scientific men have little to fear from it. The public treatment and recognition of entomologists has greatly improved. Public opinion, formed through association in numerous societies, controls the actions of scientific workers so subtly that younger men, coming to the front, would never even think of doing things which once were not uncommon. In short, we are yearly becoming more socialized, and more responsible to one another. In a manner, virtue is forced upon us; or we would prefer to say, our virtues are cultivated rather than our vices.

One very happy movement in which Dr. Howard has had a most prominent part is that for international cooperation in economic entomology. Through many hard experiences, the country has learned that the United States can not live alone in these matters. It seems grotesque that there was once great difficulty in arranging to send a man abroad to study the natural enemies of the cottony cushion scale. Now we maintain laboratories abroad, and it is considered natural and proper that our government entomologists should cooperate in every possible way with those of other countries. It was an occasion for rejoicing when a minute parasite sent from Washington to Italy brought under control one of the most dangerous scale insects of that country. One could wish that politicians and publicists in general might study the international policies initiated and developed by Howard, and become converted to the advocacy of like measures in respect to other affairs. Were this possible, the world would be a much better place to live in.

Special acknowledgment is made in the introduction to the Imperial Bureau (now the Imperial Institute) of Entomology in London and its director, Sir Guy Marshall. This organization serves the whole British Empire, and has attained an extraordinary degree of efficiency. I myself am indebted to it for most of my knowledge concerning the insects obtained during my journeys abroad. Hundreds of these insects, mounted, labelled and named, have been returned to me, and will all go to the larger American museums. Others, new to the British Museum, are retained in London. This kind of efficiency is possible to the Imperial Institute because the vast collections of the British Museum and a large group of skilled taxonomists are available. This work could not have been done in America, or could only have been done with extreme difficulty. The U. S. National Museum has not yet accepted its responsibility for the development of an adequate collection of the insects of the world.

Economic entomology, since the days when Howard and I were young, has not merely undergone tremendous developments, but has taken on new and diverse aspects. It is disconcerting to me to find that I hardly understand many of the articles now published in the *Journal of Economic Entomology.* They seem to me to be chemical engineering rather than entomology. An army of workers is concerned with the enforcement of regulations, the application of insecticides, and other matters wholly foreign to the simple entomologist of old times. The fact is, that different services require different men, and it is not to be expected that any man to-day can be occupied in all the fields of applied entomology. Dr. Howard recurs from time to time in his book to the necessity for fundamental studies, and it is in this respect that we are most deficient. It ought to be possible to produce, through international cooperation, monographs of all those groups of insects which are of prime importance to man. These should not merely describe the cabinet specimens, but should elucidate life histories, habitats, natural enemies and so forth. The ultimate value of such work, from a purely economic point of view, would be very great indeed. Were I to become young again, and get a new start, I think I should wish to be

a taxonomist as I have been, but on much broader lines, including in my studies generic, specific and varietal differences in physiological characters, in responses of all kinds to the environment. The proverbial man in the street, if he knew me and my program, might hesitate to supply the funds, fearing or knowing that I should not have my eye on his bread and butter. The motive force would not be economic, but scientific, no easier to explain than enthusiasm in playing a game. Only on that basis would the rewards come abundantly to the worker, and the pleasure and zeal be maintained. Seek ye first the Kingdom of Heaven, and all else shall be added unto you, may be adopted as the statement of a psychological principle, fully applicable to-day.

It is at this point that we sense the weakest aspect of modern American entomology. There are in Washington and in the experiment stations and universities many capable workers. But as a general thing they are intellectually dissipated by a multiplicity of duties. They may be well paid and not overworked, but they can not concentrate on comprehensive research. Many, no doubt, have long lost any ability they have had for such labors. There has been no adequate policy for the development of comprehensive scientific research in entomology and little training directed toward that end. We have been sorely deficient in imagination, and have supposed that science could be governed by laws of supply and demand.

The book is well and accurately printed, and I find few errors of any kind. Only one suggests comment. Having visited New Caledonia and followed the footsteps of the famous pioneer naturalist of that island, Pére Montrouzier, I regret to see the now important beetle which was named after him printed (in many places) *Cryptolaemus montrousieri*. I have seen this substitution of s for z elsewhere and hope by this comment to stop the too easy propagation of an error in spelling. A criticism of a quite different kind may be added. We regret that there is, among the pictures of the leading economic entomologists of America, none of the dean of them all, Dr. L. O. Howard.

It seems a long time since the eighties of the last century, when, a lone bachelor in a cabin in Wet Mountain Valley, I first entered into correspondence with the entomologists of the Department of Agriculture, and received from Washington a whole sack full of books and bulletins. The letters used to be signed by Riley, but I understand that most of them were written by Howard. The pleasure and instruction derived from them greatly stimulated my zeal and I think it must be said that in that sense the person responsible for much of what I have accomplished since, whether he approves of it or not, is my old friend Dr. L. O. Howard.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

A NEW SPRING BALANCE FOR MEASURING WATER CONTENT OF SNOW[1]

THE water content of snow is determined by weighing a known volume of snow. For example, if a cylindrical prism of snow 1.485 inches in diameter weighs 1 ounce, it contains 1 inch depth of water. To determine the water content of a snow cover a core of snow the full depth of the cover is cut out with a snow tube. This core is weighed, and from its weight the water content is determined.

The problem of weighing the cores in the field under the trying circumstances of cold and storm has presented many difficulties. The fact that measurements of the snow cover must be made on high and almost inaccessible mountains where all travel is on snowshoes or skiis requires a light, portable and convenient instrument for weighing the cores and at the same time one which will give the desired degree of accuracy. Where large numbers of measurements are made, a balance that can be read directly to 0.5 inch of water and can be interpolated to 0.1 inch of water is of sufficient accuracy.

The snow scales developed by the U. S. Weather Bureau, Church of Nevada, as well as commercial scales that have been used in snow surveying, are all spring scales and subject to the inaccuracies inherent in a spring scale. In addition, they are all dial scales, the purpose of the dial being to give a greater readable accuracy and a wider range. These scales have dials which vary from 5 to 10 inches in diameter. They are heavy, awkward to carry, and are subject to binding when the wind swings the tube which is being weighed.

To overcome some of the disadvantages of the scales now in use for measuring the water content of snow, a tubular spring balance has been developed which is believed to be more sensitive and just as accurate and further has the advantage of being lighter and more compact.

[1] Contribution from department of irrigation and drainage engineering, Utah Agricultural Experiment Station.

Publication authorized by Director, August 7, 1930.