SCIENCE NEWS

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SOME PAPERS READ AT THE RICHMOND MEETING OF THE AMERICAN ASSOCIATION AND ASSOCIATED SOCIETIES

FAITH is as important in the pursuit of scientific knowledge as intuition and reason, while "to-day the significance of science as a principal source of revelation is almost universally recognized." This was the essence of the address of the retiring president of the American Association for the Advancement of Science, Dean George D. Birkhoff, of Harvard University. The address was printed in full in the issue of SCIENCE for December 30. Dr. Birkhoff made a plea for an essentially religious attitude toward the problems of science and society, suggesting the following as articles of scientific faith: (1) It is desirable to accord reality in equal measure to all kinds of knowledge everywhere, and so to view the universe as broadly and impartially as possible. (2) In order to understand the various facts and their interrelations we must always use abstractions that is, conceptual tools of a logical or mathematical nature. (3) The transcendent importance of love and good-will in all human relations is shown by their mighty beneficent affect upon the individual and society. He pointed out that any one is free to agree or disagree with these articles of faith because they are not verifiable experimentally or strictly demonstrable.

THE address of Sir Richard Gregory, for many years editor of *Nature*, urged the duty of scientific men "to assist in the establishment of a national and harmonious social order out of the welter of human conflict into which the world has been thrown through the release of uncontrolled sources of industrial production and lethal weapons." He stated that "men of science are citizens as well as scientific workers and are beginning to realize their special responsibilities for securing that the fruits of scientific knowledge are used for human welfare. They can no longer remain indifferent to the social consequences of discovery and invention, or be silent while they are blamed for increasing powers of production of food supplies, providing means of superseding manual labor by machines, and discovering substance which can be used for destructive purposes. It would be a betrayal of the scientific movement if scientific workers failed to play an active part in solving the social problems which their contributions to natural knowledge have created. The view that the sole function of science is the discovery and study of natural facts and principles without regard to the social implications of the knowledge gained, can no longer be maintained. It is being widely realized that science can not be divorced from ethics or rightly absolve itself from the human responsibilities in the application of its discoveries to destructive purposes in war or economic disturbances in times of peace. Men of science can no longer stand aside from the social and political questions involved in the structure which has been built up from the materials provided by them.

AT the annual science exhibition practical applications to present human needs stood side by side with displays of "pure" research whose applications have yet to be found. Here, for example, was a robot "radium hound" devised by physicists at the National Bureau of Standards in Washington, D. C., which can "sniff" a millionth of a gram at the distance of a yard. It kicks over the needle on a millimeter whenever there is a trace of radioactive material in the neighborhood. Among other things, it can be used to locate "seeds" of radium that sometimes get lost in hospitals. There was an exhibit of work that Bureau of Standards engineers have been doing in brick and mortar, steel and concrete. A metal tube that sings was part of a display presided over by Professor Charles T. Knipp, of the University of Illinois. When the tip is warmer than the rest of the tube, it gives off a musical tone. The exhibit of the Boyce Thompson Institute for Plant Research, Yonkers, N. Y., showed how the tomato plant indicates by its growth responses the nature and strength of various chemicals that influence the life of plants.

A SMOKING machine was shown in the booth of one of the leading commercial tobacco companies which tested smoking qualities of endless samples of tobacco, from lots destined for use in cigars, cigarettes and pipe mixtures. A display sponsored by Duke University demonstrated the new method for keeping at bay the deadliest fungus enemy of tobacco seedlings, blue mold, through fumigation with benzol vapor.

THERE was a voting booth in the exhibit hall. The question at issue was mannose, which tastes sweet to some persons, bitter to others, and to still others has no taste at all. Some perceive it as bitter at first and then sweet, others taste the sweet and then the bitter. It is in an endeavor to get a large statistical sample of the mannose tastes of the populace that Dr. A. F. Blakeslee, of the Carnegie Institution of Washington, set up his polling booth. To all comers he gave a sample of mannose to taste. Then they registered their reactions in the booth. Drs. Oscar Riddle and Robert W. Bates, of the Carnegie Institution had an exhibit demonstrating the extraordinary effects of prolactin, a ductless gland secretion or hormone produced by one part of the pituitary gland that lies within the skull, just below the brain. This small gland, which has been called the "master gland" of the body, shares with the brain the distinction of most widespread control over the activities of organs quite distant from itself, and over the conduct and personality of the individuality as a whole.

THE technique of using electron beams to disclose tiny details in nature, far beyind the limits of any microscopes using light in the usual way, is rapidly being perfected, according to the report of Dr. V. K. Zworykin, of the Radio Corporation of America. "It can be shown that, even taking account of certain fundamental defects of

electron lenses, electron microscopes are essentially capable of resolving separations of the order 0.000001 millimeters.'' This resolution, amounting to a millionth of a millimeter, reaches down into the size of the super giant molecules which have been shown to be present in some of the filterable viruses, particularly the virus causing tobacco mosaic disease. Some of these molecules have weights 25,000,000 times greater than ordinary molecules of common chemical elements. The essential point about these huge chemical molecules of the viruses is that they are believed to represent the borderline between animate and inanimate matter. Although the viruses, at least some of them, have been shown to be chemical in nature they have been found to be capable of reproduction and possess biological activity which has always been associated only with living things. German scientists using electron microscopes are now studying colloidal suspensions and have reported the separation of detail spaced only one hundred thousandth of a millimeter apart (0.00001). The use of electron microscopes in the study of extremely minute particles has so far found its best use in studying the surfaces of glowing metal filaments of electric lights and in analyzing crystal structure in thin films of metals. Much more difficult is the study of biological specimens. The swift-flying electrons used in electron microscopes can not only kill biological specimens but can actually destroy them.

DR. THOMAS M. RIVERS, of the Rockefeller Institute for Medical Research, believes that the viruses that cause disease, and which are much too small to be seen, are a very ''mixed lot,'' having only their size and disease-causing ability in common. ''Some of the viruses,'' he said, ''may be minute, highly parasitic microorganisms, the midgets of the microbial world, capable of reproduction only within susceptible host cells, others may represent forms of life more or less unfamiliar to us, and still others may be fabrications of their host cells aided by the processes of autocatalysis. What life is and where the transition from the non-living to the living takes place, if it does, in the scheme just set forth is not known. Furthermore, the transition may be so gradual that it will be difficult for investigators to assign the particular point at which it occurs.'' Yet despite the handicaps which their minute size and often puzzling behavior imposes on research, Dr. Rivers stated that a good deal has already been found out about them. We have a pretty good idea of the sizes of some of them; they range from almost the size of some of the smaller bacteria down to that of single protein molecules. We can also infer that at least three shapes are found among them: round, oval and rod-like. We know that they commonly have the same kind of electrical charges found on protein molecules. With his co-workers, Dr. Rivers has made a special study of the vaccine virus, which is the virus of cowpox used in vaccinating against smallpox. They worked out a new method of producing it in quantities large enough to handle by laboratory methods, and thus got a good supply to study. Among other studies was a direct chemical analysis of purified elementary bodies of this virus, that is, of the tiny units that actually produce the biological results of vaccination. The dried elementary bodies were found to contain 83.12 per cent. protein, 8.54 per cent. fat, 0.72 per cent. ash, 5.56 per cent. residual moisture, 2.06 unidentified material, including a trace of carbohydrate. ''These analyses,'' Dr. Rivers stated, ''do not differ materially from those recorded for bacteria or for protoplasm.''

EVOLUTION of man and all lesser living things gains scope and takes on new grandeur by being traced far below the world of life to the very chemical elements themselves. A new visualization presented by Professor George A. Baitsell, of Yale University, bridges the gap between the living and the non-living with recent new knowledge of gigantic chemical molecules of viruses that act as though they were alive. The difference between the living and the non-living is shown to be a matter of complexity. The same materials are used in both domains and they conform to the same elemental patterns. The natural world is fused so effectively that the procession of organic development flows uninterruptedly from atom to man. There is no need to worry as to just when and at exactly what stage life was infused into the evolving stuff of the natural world. In that ultra-Lilliputian border land where the most powerful microscopes lose their sight, increasing complexity evolves into what has been labeled ''life.'' From the simplest substance in the organic world to the most complex patterns of living substance there must be a graded series. Should evolution begin at the level of the living organism? The union of hydrogen and oxygen to form water, the union of carbon and oxygen to form carbon dioxide, the union of water and carbon dioxide to form sugar, the addition of other elements to the sugar molecule to form protein—were not all these stages in the evolutionary processes which have led to ever-increasing complexity, reaching their climax in the world of life?''

THE mental disease bill for the United States during one year, 1937, was $935,723,308. This is an estimate of the total cost of mental disease based on loss of earnings and cost of maintenance of mental disease patients both in institutions and in their own homes. It was presented in the symposium on mental hygiene by Dr. Horatio M. Pollock, of the New York State Department of Mental Hygiene. The economic loss due to hospital cases of mental disease in the United States during one year Dr. Pollock figures at $803,176,308. The number of mentally sick persons outside hospitals and the extent of their disability is not exactly known, but from figures of the national health survey conducted by the U. S. Public Health Service, Dr. Pollock estimates the number of mentally sick over 14 years of age to be 266,618. The total economic loss on account of mental disease outside of institutions in 1937, figured at $1,500 a year for males and $1,000 a year for females, amounts to $132,547,000.

A CONCERTED attack on mental disease in the laboratory to supplement that going on at the bedside was urged at the symposium by Dr. Charles P. Fitzpatrick, clinical director at Butler Hospital, Providence, R. I. The whole-hearted and intelligent cooperation of workers

in biology, physiology, sociology, psychology and many other sciences must be enlisted to aid psychiatrists in solving the tremendous problem of why human beings act as they do. Central research institutes for every state hospital system are the key to the plan proposed by Dr. Fitzpatrick as the answer to America's mental health problem. Public authorities should devote from one half to one per cent. of their appropriations for mental hospitals to research. The central institute should be able to call on any hospital for research material. And individual hospitals should send men to the research institute for training in experimental attitudes and techniques. Careful cooperation between clinical staffs dealing with the patients themselves and the laboratory men at work on research problems is urged. Small state hospital systems should get together to form a group and set up a research center to serve all those states. Or they should be permitted to make use of the research center of a neighboring state. A central clearing house should serve to keep all workers in the nation informed of the work being done in their own fields and also in other allied fields. This central clearing house should have adequate library facilities and should provide bibliographies to all workers with definite projects in mind. This central unit should coordinate the research of the whole nation so that the whole army of research workers would be pulling together in perfect harmony and without duplication to solve this national problem. It could also serve to allocate funds available for research so that the whole program will be advanced in the best way. The matter of training of research personnel is an important one that would be served by such centralized research units.

PHYSICIANS and medical scientists generally would do well to investigate more thoroughly the problem of fatigue, what it does to mind and body and its possible rôle in causing mental disease, according to the report of Dr. John W. Thompson, of the Harvard University Fatigue Laboratory. A hint of a real link between the kind of fatigue that comes after muscular exertion and the kind of fatigue associated with mental disease has been obtained in as yet unpublished studies at the Fatigue Laboratory. In an unusual percentage of mentally sick patients suffering from schizophrenia certain changes in blood constituents during rest were found which are similar to blood changes resulting from exhaustive muscular exertion. Another possible indication that fatigue may have something to do with mental disease appears in the fact that a spinal reflex can be fatigued by repeated stimulation. Perhaps other reflexes can be affected by fatigue in a similar manner. Reflex activity is so related to behavior that it seems reasonable to suppose fatigue of reflexes might cause a change in behavior which would appear as mental or nervous disorder. Dr. Thompson pointed out that much more investigation is needed to show whether there is anything in the idea. But investigation into the mechanisms that result in pathologic fatigue might produce knowledge which could be used to eradicate this sort of fatigue.

THE task of providing for the mental health needs of the people is enormous and complex, but American enterprise and organizing talent may prove equal to the task. This optimistic note was sounded by Dr. C. Macfie Campbell, director of the Boston Psychopathic Hospital and professor of psychiatry at Harvard University Medical School, in summing up the deliberations of leaders in the field during a three-day session on mental health. "Mental hygiene is a broad field as it deals not with simple, well defined diseases but with the personal equilibrium and the social adaptation of the individual," Dr. Campbell said. "It is as broad as human nature. There are certain outstanding needs that cry for relief." He pointed out that the care of the 500,000 patients in the mental hospitals of the United States is very unequal. He referred in this connection to inadequate appropriations and interference of "predatory politicians." A review of this whole situation is a "primary need." It is more than an economic question, Dr. Campbell said. The community needs education as to what mental disorders mean. "They are not diseases in the ordinary sense of the word. They are the failures of individuals with their special needs to get satisfaction out of life in their actual environment. One therefore has to consider the fundamental needs of human nature and the resources of society for satisfying these needs. Alcoholism and delinquency may represent poor outlets for unsatisfied needs. Mental disorder has the same significance. We learn much about human nature from the study of mental patients for they discard conventions and culture and reveal basic human nature. Mental hygiene is a medico-social problem. Much research is required. Funds are inadequate and disproportionate to the magnitude and complexity of the task. The task involves the cooperation of scientists working in different fields: the physician, the physiologist, the psychologist, the sociologist, the economist, the cultural anthropologist."

WEATHER forecasters tried their hand at another kind of prophecy, telling how they will do their work in future years, in a paper presented by W. C. Devereaux, senior meteorologist of the office of the U. S. Weather Bureau in Cincinnati. This paper, Mr. Devereaux explained, was not written by himself alone, but represented the opinions of a large number of Weather Bureau scientists, sent at the request of the late Dr. Willis R. Gregg, until recently chief of the bureau. Fifty years from now television instruments will enable a man to stand at one spot and look at the skies of a thousand different places all over the earth. He will also be able to read the records of robot instruments on mountain-tops and carried aloft by airplanes, balloons, possibly even rockets, all automatically broadcast for any interested observer to pick out of the air as he chooses. The weather map of the future will not be the flat, two-dimensional affair of yesterday and to-day. It will rise into the third dimension, telling conditions high aloft as well as on the ground. It will indicate conditions to come not for a mere day or two but for several weeks in advance. And it will be distributed so rapidly that a farmer in the field or an engineer far off in the lonely mountains can keep himself constantly posted on the whole world's weather. Weather study will no longer

be a practical monopoly of the Weather Bureau. This will still be the central agency, but every university and college will have its faculty meteorologist, and all important business firms will maintain cooperating weather services.

DR. CHARLES S. PIGGOT, of the Geophysical Laboratory of the Carnegie Institution, presented a report of the preliminary findings of his exploration of the depths of the ocean with his deep-sea sounding device. It provides a way to study the past of the earth. In the deeper parts of the ocean the record of the earth's history is preserved in layers of sediment, deposited in orderly sequence, century after century, recording what happened both on land and in the sea. Two miles and more beneath the ocean's surface a pipe-like drill has been forced up to 10 feet into the mud by the explosive force of artillery powder. The samples thus obtained have given surprising information. There were four ice periods and five eras of water warmer than now in the Atlantic Ocean, new evidence of the famous ice ages of the Pleistocene geologic era which just preceded the present. The magnetic pole of the earth wandered widely as shown by small pieces of magnetic minerals, little compasses in effect, that still point the way they did when they fell to the bottom of the sea thousands upon thousands of years ago. At one period of the earth's past there was a strange age of giants among shells that fell to the ocean's bottom. A new core sampling device, hung on 7 miles of special steel cable, will go into exploratory service this spring.

YOUNG plant tissue has shown potential ability to stay young forever, in cultures prepared by Dr. Philip R. White, of the Rockefeller Institute for Medical Research, Princeton, N. J. Dr. White, who was winner of the $1,000 prize of the American Association a year ago, reported his newest researches before the closing session. The living material used in the experiments was taken from a hybrid ornamental Nicotiana plant, and consisted of stuff called callus. Plant callus is a mass of undifferentiated, unspecialized cells that form when the plant is wounded; it is essentially embryonic, or physiologically young tissue. Dr. White kept his bits of callus in specially prepared nutrient solution consisting of a sugar, certain necessary mineral salts, together with vitamins and plant hormones which have been found essential to growth. The tissue grew and grew, but the cells showed almost no tendency to mature into any of the specialized forms found in plant organs. It was immortally young. Each week he discarded part of the growth and kept the rest. At the end of the week new growth would have increased the pieces to three times their original size. This kept up for forty weeks. By that time, he calculated, had he been able to keep all of the tissue as it grew, the original piece would have increased to 10 to the 19th power (10,000,000,000,000,000,000) times its original size. For several years, Dr. White has kept cultures of roots going, unattached to any parent plant, but this is the first time that it has been possible for him to produce unspecialized tissue that is "just plant."

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