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SOME PAPERS READ BEFORE THE DALLAS MEETING OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE AND ASSOCIATED SOCIETIES

Totalitarian governments fight against nature itself when they try to make every one alike, was pointed out by Dr. A. F. Blakeslee, president of the American Association for the Advancement of Science, in the principal address at the Dallas meeting. He said: "Opposition to totalitarianism is not merely because it attacks man's rights but also because it suppresses his personality. Individuality is the kernel of democracy, the biological basis of the struggle for freedom. When we fight for individuality we fight on the side of nature." In support of his thesis, the speaker cited many examples of unpredictable individual differences among superficially similar persons—differences reaching even to such things as inability of some to taste or smell substances that are extremely disagreeable to others. Everywhere in nature, individual differences are the universal rule. "Like as two peas" is not only trite but untrue: it should run, "Unlike as two peas." Dr. Blakeslee also defended science against the charge of ruining the world through helping to make war more deadly and destructive. Admitting that some of the contributions of science have been perverted by evil men to evil uses, he believes that this is more than offset by the life-saving functions of science even in war. "Deaths due to battle injuries increased from 15 per thousand for the Mexican War through 33 for the Civil War to 53 for the first World War," he stated. "The death rate due to disease, however, decreased from 110 through 65 to 19 for the World War. The result is that the total death rate declined from 125 in the Mexican War through 98 in the Civil War to 72 per thousand in the World War. It is a satisfaction to feel that though implements of war have increased in destructiveness, those who are fighting to preserve our free way of life may not be subjected to greater risks than our forefathers assumed when they too fought for their country."

Dr. Edwin P. Hubble, of the Mount Wilson Observatory, pointed out in the annual Sigma Xi lecture that the universe that will open up before the giant eye of the 200-inch Mount Palomar telescope, when it goes into action a few years hence, may turn out to be "small," in the sense of being finite. The finiteness of the universe, if it is established, will be a consequence of the curvature of space, as conceived in the relativity theory. This theory envisions space as being warped or bent in the presence of large masses of matter; the larger the mass the greater the bending. To make such a universe fit certain observed facts within the reach of present-day telescopes, it is necessary to assume so great a degree of curvature that as much as a fourth of the total volume may even now be within telescopic range. However, an opposite interpretation may be placed on the observed phenomena that have led mathematicians and astronomers to speak of curved space and a closed or finite universe. The so-called red shift—the progressive reddening of light from stars rapidly speeding away from us—would mean, in a "straight-line" way of looking at the cosmos, that the universe is actually infinite, and that the part of it we can see without telescopes is an exceedingly small fraction of the whole. "On the basis of the evidence now available," said Dr. Hubble in conclusion, "a choice seems to be presented, as once before in the days of Copernicus, between a small, finite universe, and a sensibly infinite universe plus a new principle of nature. And, as before, the choice may be determined by the attribute of simplicity."

Recent experiments on the scattering of electrons by light gases, hydrogen, helium and the lighter hydrocarbons, especially designed to decide between the classical mechanics and the new wave mechanics, resulted decidedly in favor of the latter, according to Dr. A. L. Hughes, retiring vice-president of the section on physics. In one particular case, the wave mechanics predicted just half the scattering given by classical formulas. Experiment showed the wave mechanics was right. The scattering of electrons was also found to be identical with the scattering of x-rays under similar circumstances. The classical mechanics assumes that forces in the atomic world obey the laws laid down by Newton, which do work well for larger masses. Wave mechanics assumes that with every electron is associated a wave, and this "wave function" modifies its behavior in ways that can be calculated by the theory.

Viewing invisible particles as huge, rugged, three-dimensional chunks that "stuck out" from the projection-lantern screen, an audience of physicists sat in something like schoolboy awe, while Dr. V. K. Zworykin and Dr. J. Hillier, of the RCA Research Laboratories, explained this latest wonder of the electron microscope. The electron microscope, now becoming well known for its capacity to make visible on a large scale details too fine to be detected at all with light-using instruments, produces its images by means of magnetically focussed streams of atomic particles. Hitherto it has been used only to take pictures from a single "shooting angle," so that its micrographs were like single, "flat" photographs. The problem of making the instrument take stereoscopic pictures, that is, shots from two slightly different angles, has been solved. The specimen holder is so built that it can be rotated through 180 degrees between exposures. The resulting photographs are then mounted so that they can be viewed through a stereoscope. Or, the twinned pictures can be made into a double lantern slide, viewed with special Polaroid goggles.

The "law of the jungle" does not apply to human relations, Professor Alfred E. Emerson, of the University of Chicago, stated in his address as president of the Ecological Society of America. The principle of cooperation is found working in all living organisms, he said, and is far more important in the evolution of human society than is the "struggle for existence" between human individuals or human groups. Over-emphasis upon the principle of natural selection proposed by Darwin and failure to keep abreast of later scientific concepts were held responsible for the persistence of this over-simplified, oversanguinary outlook: "Darwin emphasized natural selection as the basic mechanism of evolution. To-day we feel that our knowledge of the genetics of variation and the rôle of isolation gives us a clearer picture of evolutionary dynamics. However, natural selection is still of tremendous importance, not so much as the prime factor in the origin of all species as it is the explanation of practically all complex adaptation."

Genes, that determine hereditary characters in human beings as well as in lower organisms, are coming to be better understood in our own race despite the difficulties of studying them, according to Professor Laurence H. Snyder, of the Ohio State University. Certain genes, especially those that produce physical defects and constitutional diseases, have been traced to the particular chromosomes that are their abiding-places, and in some instances even their particular locus on a chromosome has been determined. Most success has been achieved in the study of defects and other hereditary characters connected with the sex chromosomes. If a particular trait is inherited only by the sons in a given family line, the first place one would think of looking for it would be on the microscopic bit of protoplasm in the nucleus that determines that its possessor shall be a male. And very frequently such leads have led to positive results.

Evolutionary changes appear rapidly at high living temperatures, more slowly in chilly environments, according to experiments of Professor H. H. Plough and Dr. George P. Child, both of Amherst College, who discussed different aspects of this phenomenon. They used as experimental animals the little vinegar fly or pomace fly, *Drosophila*, partly because its small size and simple living requirements make it easy to rear huge numbers in limited space, partly because long study of this particular species has resulted in a better knowledge of its heredity than that of any other organism. Mutations, or abrupt evolutionary changes, appeared about five times more frequently among the offspring of a given number of animals in a "warm" colony than among the same number of offspring kept at a temperature ten degrees colder. It does not seem that high temperature in itself is the cause of mutations, since mutations appeared also among the insects kept at low temperature. More probable is the assumption that the natural tendency of all living things to change is intensified by the speeding-up of life processes that occurs when it is warmer.

Electricity's intimate tie-up with life itself is strikingly shown in experiments with apparatus displayed at the exhibit of the University of Texas. Research with this apparatus, so delicately adjusted that single cells of living plants can be picked up and accurately manipulated, is being conducted by Dr. E. J. Lund and his associates. One of the devices picks up a single thread of a lower waterplant, or alga, and dips its end in a tiny cup of water. The exceedingly minute current of electricity which it generates as long as it is alive is recorded. The electrical potential is shown to be higher near the ends of the long cells and is at its highest in the region of the actively growing tip, where life is most intense. Another device shows how a small plant, when laid on its side, instantly becomes positively electric on its under side, negatively on its upper side. About half an hour later, the tip begins to bend upward at the point where the electrical difference developed. In a third piece of apparatus, tiny onions are grown in such a way that electric current flows downward along one set of roots, upward against a second set. The downward current has no effect on the rate of growth, but the upward current causes a slowing of growth in the roots that are pointed against its direction.

Through lowly bacteria that shine in the dark, new light has been shed on the old puzzle as to why certain substances "put you to sleep." Experiments bringing out new facts in the old problem of narcosis were reported before the meeting by Professor Frank H. Johnson, of Princeton University, and Professor Dugald E. S. Brown and Professor Douglas A. Marsland, both of New York University. Drugs like ether, chloroform, alcohol and novocaine caused bacterial luminescence to "go out like a light." If the vessels containing the bacteria were placed under pressure, however, the reaction was reversed and the bacteria lighted up again. Investigation of the chemistry of the reaction showed that the drugs produced their effect by combining with the enzyme that oxidizes the luminous compound of the cells, causing it to glow. Pressure "pried the drug loose" from the enzyme, permitting it to act again. This was proved by experiments in which no living bacteria were involved, but only the non-living compounds which had been extracted from the cells. This new theory of narcosis through drugs combining with an enzyme at least partly displaces the older theory still presented in most text-books, that narcotics act through combination with fatty material in cells.

Large-scale chemical analysis of the nucleoproteins, which might without exaggeration be called the essence of life itself, has been made possible through a simple method of extracting them from living cells with a strong salt solution, according to a report by Dr. A. W. Pollister and Dr. A. E. Mirsky, of Columbia University and the Hospital of the Rockefeller Institute for Medical Research, read at the meeting of the Genetics Society of America. Nucleoproteins are what the nuclei of cells are made of, and since nuclei are at once the directors of physiological activities of the cells and the containers of the genes that determine the course of heredity, the importance of a better knowledge of their chemistry is obvious. Until now, however, it has been extremely difficult to obtain sufficient quantities of these substances to make satisfactory analyses. Drs. Pollister and Mirsky stated:

''We have found that when fresh spermatozoa or fresh cells of such organs as thymus, liver, kidney, or pancreas are soaked in a strong salt solution (5.8 per cent. sodium chloride) the nucleoprotein goes into solution in considerable amounts—adequate for very complete analyses. Microscopic examination of the cells after soaking shows that the nuclei, which are usually full of chromatin, are now empty—a direct demonstration, for the first time, that the extracted nucleoprotein comes from the chromatin. By this method we shall now be able to extract and to analyze the nucleoproteins from many types of cells. By comparing these nucleoproteins we shall be able to discover what chemical changes occur in the chromatin when, in development, embryonic cells become the specialized tissue cells such as those of glands, blood, muscle, brain, etc. This may bring us much nearer to an understanding of exactly how the genes in the chromosomes operate in development.''

Electron photomicrographs of almost unimaginably thin linings of insect breathing-tubes were shown to the meeting by Dr. A. Glenn Richards, of the University of Pennsylvania, and Dr. Thomas F. Anderson, RCA Fellow of the National Research Council. Some of the details, invisible even with the highest powers of light-using microscopes, help to explain why certain insects are resistant to poison dusts and fumes while others are not. The photographs, made with streams of atomic particles instead of waves of light, show that although the uppermost layer of the cuticle lining a cockroach's breathing-tubes (which serve insects in place of lungs) is only 2.5 microns (one ten thousandth of an inch) in thickness, it is composed of two layers, the thinner of which has a thickness of the order of a hundredth of a micron.

Despise not the humble, homely toad. He may not be able to charm your ear like a hermit thrush, or please your eye like a bluebird, but he's more useful than either when it comes to destroying insect enemies. He's right down on the ground, where some of the wickedest insects are, and he's on the job in the dusky hours when songbirds are fast asleep. Before the meeting of the Ecological Society of America, Charles C. Smith, of Monroe, La., and Dr. Arthur N. Bragg, of the University of Oklahoma, reported their study of the highly beneficial food habits of several different species of toads. They have enormous appetites, though the time-honored notion that a toad must fill its stomach four times a day seems doubtful. Digestion, in fact, is rather slow. Favored foods include grasshoppers, chinchbugs, cutworms, leaf-beetles. Toads, it appears, are not specialists. Big toads go especially for big insects, little toads for little ones. But they're not fussy about kinds and varieties. Anything that crawls on multiple legs is fair game for a toad.

Masses of plant tissue, separated from the parent plant and growing in laboratory dishes of nutrient solution, are yielding answers to old puzzles about life processes that could not be learned from whole plants because they are too complex, Dr. Philip R. White, of the Rockefeller Institute for Medical Research, stated in the Stephen Hales Prize address before the American Society of Plant Physiologists. The ideal goal of the tissue culturist, Dr. White said, is to obtain a single plant cell and make it live and grow all by itself. This has not yet been attained; the nearest scientists have come to it is the culturing of bits of fairly uniform, undifferentiated tissue, with thousands of cells all essentially alike. With such tissue cultures, the limits of the requirement of plant tissues for iron have already been determined. Any solution with a concentration of more than one part of iron to 50,000 of water is poison to the cells. Yet if the solution entirely lacks iron the tissue stops growing and will not resume growth until at least a trace of iron is supplied. Other tests have suggested that plant cells prefer to feed on sucrose (cane sugar) rather than the simpler sugar, glucose; a conclusion at variance with the statements in most text-books. Still further researches are being conducted on mineral requirements, vitamin, enzyme and hormone reactions, and other physiological problems simplified by the undifferentiated samples of plant life in the laboratory dishes.

If we of modern times could walk in a forest of 50 million years ago, we should see some very familiar-looking trees—redwoods, bald cypress, hickory, oak—even though the animals would look like nothing on earth today. Yet the forest would be a strange one for all that, was pointed out by Professor Ralph W. Chaney, of the University of California, because of the very mixture of trees just mentioned, plus some additional species now found only in eastern Asia, like the ginkgo tree. The forest—any forest—of the 50-million-years-ago Tertiary period was a grand mixture of trees now found only in widely separated parts of the earth. Thus, the redwoods are found only on the Pacific coast of North America, the ginkgo only in Asia, the combination of bald cypress, hickory and oak only in the southeastern United States. Many thousands of years of climatic changes, of slow rise of mountain masses, of thrusting of deserts and dry grasslands into the once continuous forest belt, have acted to bring about this separation and sifting of species.

A NEW science, paleogrostology, or the study of ancient grasses, was introduced, when Dr. Maxim K. Elias, of the University of Nebraska, presented the results of his long study of fossil seeds found in the same rock strata of the West that have yielded the bones of early forms of horses, camels and other herbivorous animals that lived on this continent in the Tertiary geologic period. Seeds proved the most dependable plant parts for identification of these ancient grasses. Earlier identifications of leaves and other vegetative parts have sometimes described as grasses plants that are not grasses at all. Examination of fossil grass seeds from successive strata of rocks yielded evidence that climates of the ancient West went through slow swings from dry to moist and back to dry again, many times. Interesting also is the change in the types of teeth in the jaws of herbivorous animals after the evolution of the grasses began.