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THE SOUTHAMPTON MEETING OF THE BRITISH ASSOCIATION

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Man can look millions and millions of miles into stellar space, but has not penetrated the earth directly more than a mile or so. Yet science has been able to discover the constitution and properties of this ball to which man is fixed during his life. One by one the secrets of the globe are being surrendered to the organized curiosity and ingenuity of man, declared Professor Horace Lamb, president of the British Association for the Advancement of Science, in his annual address at the opening session of the association at Southampton.

Professor Lamb is one of England's most distinguished mathematical scientists. A graduate of Cambridge, he was professor of mathematics in the Owens College and University of Manchester from 1885 to 1920. He is a fellow of the Royal Society, foreign member of the Royal Academy Di Lincei of Rome, and has received honors from many universities.

In his address, Professor Lamb explained that the earth, instead of having a molten, flaming center, as was formerly supposed, has a hard, rigid metallic heart, as stiff as steel. Sixty miles below the surface is a stratum of viscous material, neither solid nor fluid, on which the mountains literally float. The heaviest and densest parts of the earth's crust, he stated, are the sea bottoms.

Since the crust of the earth hardened and became relatively stable, Professor Lamb said, somewhere between one billion and ten billions of years have elapsed, an age for the earth giving "ample scope for the drama of evolution." Compared with this, the six thousand years allowed by the Fundamentalists' literal interpretation of the Bible is mere watch-tick.

The age of the earth, Professor Lamb explained, has been scientifically estimated by a study of the radio activity of the rocks of which the crust is composed. Radium and similar elements decompose at a known rate, and by comparing the degrees of radio activity of rocks of various geological periods, and noting how much this activity has "slowed down" in the older formations, it has been possible to establish a time scale for the age of the crustal rocks.

Although not a flaming mass, the central portion of the earth is as hot as the primitive conception of Hades, said Professor Lamb, for it is enclosed by a thick envelope of material that is but feebly conductive of heat, just as a steam boiler is jacketed with asbestos. Over half of the earth's original heat is thus retained.

Tides move through this rigid, solid earth, as they move through the ocean; though they are only a few ten thousandths of an inch instead of the many feet we see in the oceanic tides.

The study of the way earthquake shocks travel through the earth has told us much concerning its interior condition, Professor Lamb explained. Nearly a century ago Kelvin, the noted British physicist, learned that the interior of the earth is as rigid as steel, and earthquake waves traveling through it follow the same rules of physical behavior as though they were traveling through solid steel. They move at the leisurely rate of 2½ to 7½ miles per second. They reveal the fact that all but the central quarter diameter of the earth is elastic. This central mass is plastic under long stresses, but rigid to short-length vibrations—and these short vibrations may be as much as a day or a fortnight in length. This innermost part of the earth thus seems to behave more or less like pitch or tar, which will slowly bend under gradual pressure, but resists a sudden thrust or blow, even to the breaking point.

A novel peacetime use of submarines was predicted by Professor Lamb. An undersea vessel planned to carry new gravity-determining apparatus has been perfected by Dr. Victor Meinesz, a Dutch scientist. It will survey and chart the gravitational attraction of the dense sea bottoms, now inadequately known.

An Adamless insect Eden was disclosed by the report of a special committee. Moths and sawflies, under the observation of these scientists, had propagated their kind for thirteen and nine generations, respectively, without the intervention of the male of the species. During all this time no weakness was discovered, and only eight males appeared among two thousand insects produced by this scientific virgin birth. Such extreme feminism is known to scientists as parthenogenesis. The committee now proposes to apply their methods to the production of vertebrate animals, such as frogs.

Imagine a human giant sixty feet tall. Small boys, impatient at the slowness of the growing-up process, might imagine sixty feet, ten times as tall as the tallest policeman, would be the height of bliss. But would it? Dr. J. B. Haldane, Cambridge biologist and writer of the most fascinating popular biological literature in the world, has his doubts and he expressed them recently before the meeting of the British Association for the Advancement of Science.

The trouble would lie in the disproportion of parts, Dr. Haldane explained. A sixty-foot man would weigh a thousand times as much as a normal man—that is, about a ton—but his thigh bone, to which the muscles necessary for standing and walking are attached, would have its area increased only one hundred times. Therefore such an unfortunate monster would break his legs the moment he attempted to move.

Dr. Haldane's imaginary giant was a picturesque illustration of a sober discussion of the functional significance of size before the biologists present at the meeting. The giants that really live among us, he pointed out, like the elephant and rhinoceros, have their legs thickened to an extent that seems disproportionate to us, but this is

necessary if their unwieldy bulk is to be moved at all. The whale gets along with a relatively slight skeleton, because most of his immense weight is buoyed up by the water.

Small size, Dr. Haldane continued, confers certain advantages.

A mouse falls down a mine shaft third of a mile deep without injury; a rat falling the same distance would break his bones, a man would simply splash.

Other factors than simple physical strength of bone and muscle material limit size, however. Dr. Haldane pointed out that there is no reason why a whale should not grow to unlimited size except that his digestive system is relatively limited. His enormous mouth is testimony to the difficulty of keeping so huge a body fed. There would be no reason why insects as large as men should not exist, except that they do their breathing by tubes reaching into their bodies and opening directly to the surface, with no provision such as we have for getting air in and out. Even the monstrous dragon flies of the remote past, which had a two-foot wing spread, had bodies as slender as a lead pencil, limited by the inefficiency of their breathing apparatus.

Eyes seem to increase in efficiency with the ratio of their size to the size of the body. Dr. Haldane suggested that Dr. Barnard, co-discoverer of the cancer germ, might breed elephants with eyes relatively as large as mouse eyes, for such yard-wide optical organs would see ultra-microscopic objects.

Dr. Haldane does not think much of the flea's vaunted superiority as a jumper. Ability to jump, he said, is independent of size, the real champion jumpers of creation are man and his friend the horse, both of whom can make seven-foot leaps. The best the flea can do is a foot.

The exhibition of the biological section of the association rivalled Dr. Haldane's imagination. B. K. Das, a scientist from the Orient, showed living specimens of the famous climbing fish of Bengal, India. This species, known as *Anabas scandens*, quite lives up to his name—"scandens" means "climbing"—for it actually does climb coco trees. Dr. Das, however, denied the rumor that it invades gardens and battles with its fellows over angle worms as robins do. So used is this fish to being out of water that it drowns if kept in it too long. It absolutely must have atmospheric air to breathe.

There are five species of Indian fish that have developed air-breathing apparatus, some with, others without, auxiliary gills. This, it was pointed out, is an example of present-day evolution quite different from the way amphibians and higher animals arose.

A report on English dietary presented at the meeting shows that the "roast beef of old England" is losing ground. Roast pork is gaining preference, eggs and bacon still hold their old place as a breakfast dish. The English seems to be growing fonder of potatoes.

Snatched from the realm of the infinitesimally small and magnified to visibility on the stereopticon screen, the organism blamed for human breast cancer was shown to the scientists assembled at the meeting of the British Association for the Advancement of Science. These minute bits of living matter, so small that they can pass through the pores of a fine porcelain filter able to strain out of a solution the smallest bacteria visible under a powerful microscope, can be detected only by means of the ultra-microscope.

The latest developments in the ultra-microscope are the work of J. E. Barnard with Dr. Gye, co-discoverer of the cancer germ, who addressed the association. The ordinary microscope using its highest power can make visible to the eye objects as small as the shortest wave length of visible light which is roughly speaking about one five hundred thousandths of an inch long.

The ultra-violet radiations, however, have even shorter wave lengths with which one can pick out objects invisibly small and though they can not make them directly visible to the eye they can register their image on a photographic plate. The ultra-microscope makes use of these rays of extremely short wave lengths, and since these rays can not pass through glass, it is equipped with lenses of pure quartz. With this instrument the hitherto invisible filter-passing organisms have been detected and photographed.

But Dr. Barnard is not yet satisfied with his conquest of the infinitely little; he is reaching out into worlds smaller still and is now building a super-ultra-microscope using Schuman rays, which have the shortest known wave length, passing them through fluorite lenses in a vacuum, thus avoiding even the disturbing effect of air. With this apparatus he expects to be able to register on the photographic plate the images of actual molecules of matter as well as the still unknown germs of small-pox, measles, whooping cough and other diseases due to filter-passing organisms. As an example of the size of the objects he hopes to photograph, Dr. Barnard mentioned the starch molecule, which is calculated to be only one one hundredth the size of the filter-passing organisms now being photographed.

The use of the intense cadmium light now permits Dr. Barnard to get photographs of his organisms enlarged to three thousand diameters in one tenth of a second. This opens the way to motion picture records of the growth and activities of germs. This huge enlargement shows the jelly-like agar culture medium on which germs are commonly cultivated to have a spongy structure, with channels of fluid in it, like a field cut by irrigation ditches. In the ultra-microscopic landscape the cancer germs take the place of cows feeding on the banks. This discovery will be of practical value in the laboratory, where germs are grown for purposes of experiment.

The Britons were addressed by a noted American scientist, Professor Yandell Henderson, the Yale physiologist. Dr. Henderson's topic was congenial to British as well as American tastes, for it concerned athletics. The normal human heart, he said, pumps one and one half gallons of blood each minute, while that of a vigorous athlete circulates eight to nine gallons. The heart action decreases from thirty to forty per cent. when a normal person stands up.

The history of Egypt was pushed back to a time thirteen thousand years before Christ and hooked up with the later old stone age of Europe when Sir Flinders Petrie, noted Egyptologist, discovered beneath the oldest pre-

viously known settlement the remains of a flint-using culture similar to that known in Europe as the solutrean.

An ivory statue that was unearthed links Egypt with Asia, at an extremely early date.

Pottery finer and thinner than any made subsequently was also found. The culture or civilization period thus marked has been named the "Badrarian," from the place of its discovery, near Asyut. Its antiquity was determined accurately by a study of the successive yearly floodmarks of the Nile.

The early civilization of Britain was connected with that of the Egypt of Tutankhamen's day by Sir W. Boyd Hawkins, who discovered buried at the famous and mysterious Stonehenge a number of Egyptian beads dating from the reign of Tutankhamen's predecessor and father-in-law, Anhnaton, in 1360 B. C.

This is the first clue to the date of these megalithic monuments, which have long been one of the great archeological riddles of the world.

THE TRANSMUTATION OF LEAD

FURTHER evidence in favor of the transmutation of the elements comes from the experiments of Arthur Smits and A. Karsen, of Amsterdam. They followed the general method by which Professor Miethe, of Berlin, claims to have obtained gold by passing a strong electric current through mercury vapor. The Amsterdam chemists undertook the decomposition of lead instead of mercury. This was more difficult, since lead is converted into vapor at much higher temperature, and considerable time was consumed in constructing a practicable ultra-violet ray lamp of quartz with lead in place of quicksilver.

The rays given off were examined with a quartz spectroscope. After a current of thirty to thirty-five ampères under a pressure of eight volts had passed through the apparatus for six hours certain lines characteristic of mercury began to appear in the spectrum. These gradually strengthened until after ten hours the entire series of mercury lines and also those of the rare element, thallium, were perceived in the visible and ultra-violet parts of the spectrum.

The lead employed was specially prepared and purified for the purpose by Kahlbaum, of Berlin. If the lead was indeed absolutely free from other metals, the experiment appears to prove that lead can be broken up into at least two other elements.

The question of possible impurity of the metal at the start is the basis of the criticism of these alleged transmutations. A new and sharp attack on Miethe's experiments comes from the laboratory of the Berlin University Chemical Institute where E. H. Riesenfeld, Wilhelm Haase, Erich Tiede, Arthur Schleede and Frieda Goldschmidt find that the process of purification employed by Miethe prior to the passage of the electric current did not altogether remove the traces of gold that occur commonly in mercury. By distilling the mercury three times in a vacuum they were able to obtain mercury that gave no indication of gold, even by the most delicate test, and when this was used in an electric lamp according to Miethe's method, no gold was obtained.

But Professor Miethe says: "My newest method yields an amount of gold far greater than my previous method; in fact enough to permit me to determine gold by the standard chemical tests." This new and more powerful method has not yet been tried on the Riesenfeld gold-free mercury.

Professor Miethe also found, besides the gold, traces of another metal in the mercury and this he takes to be silver. Professor Nagaoki, of Tokyo, who reported getting gold from mercury by electrical action, also found a white metal which he thinks is platinum.

If these experiments are confirmed, chemists have acquired the power of changing lead into mercury and thallium, and then the mercury into gold and silver or platinum. This would open a new era in the sciences, the synthesis of the elements.

ITEMS

THE female sex principle, recently detected for the first time by Dr. Edgar Allen, of Columbia, Mo., and J. P. Pratt, of Detroit, has been isolated from the circulating blood of a number of animals by Dr. Robert T. Frank, of the Research Laboratory of the National Jewish Hospital for Consumptives at Denver. Dr. Frank found that the secretions in the blood are much greater at periods of high sexual activity than at others, and it seemed that the blood or extract of it at such times might be used to induce normality in other animals and even human beings who are below normal. It was absent from the blood of males and of sexually subnormal females.

SCIENTISTS have upset the dope of hard-hearted trainers who rule candy off the diet of athletes. Dr. Burgess Gordon and several other physicians of Boston have found as a result of experiments that marathon runners who have lived on a generous carbohydrate diet during the training season and who eat candy before and during the race not only come out ahead but are also in much better physical condition than those who run unsweetened. The experimenters got the hint that sugar had something to do with the physical condition of runners when a series of blood tests made a year ago after the American marathon race, revealed that those who were most exhausted showed very low blood sugar and others, less exhausted, showed a somewhat higher sugar percentage. Some extreme cases even presented an appearance similar to that of shock produced in diabetic patients by an overdose of insulin, a substance necessary to the proper disposal of sugar in the blood and which diabetics lack. Results of blood tests made accordingly, using sugar rations during this year marathon, have just been made public. Runners were placed on high carbohydrate diets before the race, besides being given large doses twenty-four hours before and supplied with candy and oversweetened tea at wayside stations. The blood tests after the race showed normal blood sugars in all cases in contrast to previous results. There was striking improvement in general physical condition and running time was faster in many cases.