

able piece of clockwork, which solves in an elegant way the problem of uniform motion in the particular case where there is no work to be done. Its success is so complete that every day I am able to start the mirror at 400 revolutions per second and to watch the two pieces of apparatus go in agreement of about 1/10,000 for whole minutes together.

Yet, in spite of having obtained such certainty on the side of measuring the time, I was surprised to find in my results discrepancies which were not in accord with the precision of the methods of measurement. After quite a long search, I finally found that the source of error was in the micrometer, which did not admit of nearly the degree of precision which we assumed for it. To meet this difficulty, I introduced into the system of observation a modification which finally resulted in a simple change of variable. Instead of measuring the deviation micrometrically, I adopt a value for this defined in advance, it shall be 7/10 of a millimeter or 7 whole divisions of the image, and I find by experiment what distance to establish between the scale and the revolving mirror to produce this deviation; the measurements have thus a length of about 1 meter, the lesser fractions still have a size visible directly and no longer allow room for error.

By this means the apparatus was cleared of the chief cause of uncertainty; since then the results have agreed within the limits of error of observation and the averages have been so constant that I am able to give with confidence the new value which it seems to me ought to represent something very close to the speed of light in space, namely: 298,000 kilometers per second of mean time.

Science News Letter, September 24, 1932

GENETICS

Dingo-Wolf Hybrid In Australian Zoo

SUCCESSFUL crossing between the dingo, wild dog of the Australian bush, and a male European wolf is reported in *Nature*. The litter of six pups, all female, was born in the zoological garden at Adelaide, Australia. One of the animals has been sent to Melbourne for hybridization experiments.

It is well known that dingo and domestic dogs can interbreed, but the present is apparently the first case on record of a cross with a wolf.

Science News Letter, September 24, 1932

GENERAL SCIENCE

Scientist Makes New List Of Extremes in Nature

THE BIGGEST elephant, the smallest germ, the shortest dwarf, the highest mountain, all the things of the universe to which can be applied the superlative "est," stir the human imagination.

Dr. B. S. Hopkins, University of Illinois professor who wrote his name into chemical history a few years ago by discovering the element illinium, has compiled in an article in the *Scientific Monthly* a list of the extremes of nature.

"Our natural curiosity which is stimulated by the use of the superlative degree is reenforced by the needs of our modern civilization," Dr. Hopkins observes. "A study of the extremes of nature soon passes far beyond the realm of mere curiosity and establishes itself as a means by which we can measure our progress in solving the problem of selecting the best material to serve our purpose in a certain specific application."

Some of nature's extremes include:

The heaviest substance known upon our earth is osmium, with a density which varies from 21.3 to 24.

The lightest substance known is hydrogen gas, unless there be considered highly evacuated X-ray tubes which

(Continued From Page 192)

more feet deep. Since the discharge of the electroscope in general is due to the cosmic rays and the radioactivity of the earth, the investigators feel that this location in and above non-radioactive water gives the best conditions under which to pursue their investigations.

Up to this time Dr. Millikan has obtained much evidence as to the nature of the cosmic ray by observing its effects through the eye piece on the electroscope. The newer apparatus contains a photographic film for permanently self-recording these effects. These records should render further repetition of these measurements unnecessary since any one interested will henceforth only need to come and measure up the films for himself, for these films will be completely free from the preconceptions as well as the errors of the individual observer.

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contain streams of electrons which are fragments of disrupted hydrogen atoms.

The hardest material is the diamond.

The most ductile and malleable of our metals is gold.

The highest temperatures which have been sustained for a considerable time and measured with reasonable accuracy are in the neighborhood of 3500 to 3800 degrees Centigrade.

The most extreme cold that has ever been reached is the melting point of solid helium, 272.2 degrees Centigrade below zero which is within eight-tenths of a degree of absolute zero, that theoretical point where all heat vanishes.

The most costly substance known to commerce is radium which sells at a price that corresponds to more than two million dollars per troy ounce, making radium worth more than a hundred thousand times its weight in gold.

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PLANT PATHOLOGY

Enzyme Theory of Virus Disease Upheld

EVIDENCE that the so-called "virus diseases" of plants and animals are caused by a non-living chemical substance that can attach itself to living matter, rather than by ultra-tiny living organisms, is claimed as the result of experiments on tobacco plants performed by Dr. Carl G. Vinson of the University of Missouri. Dr. Vinson's work apparently supports the belief, held on theoretical grounds by many physiologists and pathologists during the past thirty years, that the causes of these mysterious diseases of plants and animals are compounds analogous to enzymes, the digestive and respiratory "ferments" of normal organisms, but malefic rather than beneficent in their effects.

Frozen and Squeezed

Dr. Vinson's method of isolating the virus of tobacco mosaic was worked out during four years he spent at the Boyce Thompson Institute for Plant Research at Yonkers, N. Y., prior to coming to the University of Missouri. The first step was to freeze a quantity of

mosaic-infested tobacco plants. Then the dead plants were put under heavy pressure, squeezing out their juice.

Samples of this juice, filtered free of large particles, caused leaf mosaic when injected into healthy plants. The virus was thus evidently in the juice.

The next step was to separate the juice into its various constituents, and find which of these could cause the disease and which could not. This Dr. Vinson did by adding acetone to the cold juice. This brought down a solid precipitate. The liquid left after precipitation could no longer cause the disease, but a solution of the precipitate could do so. The virus was thus evidently in the precipitate.

Concentrated by Steps

Dr. Vinson's further work has been in the greater refinement and purification of the precipitate, each step obtaining a more concentrated form of the virus. He states that analyses indicate its chemical makeup to be that of a protein or of some compound very similar to proteins. It is regarded as probable, however, that not the whole protein molecule is the real mischief-maker, but some relatively simple group of atoms that is attached to it or a part of it. Such an atom-group could conceivably attach itself to other protein molecules in healthy protoplasm, thus providing a mechanism of infection and propagation.

Science News Letter, September 24, 1932

SEISMOLOGY

Earthquakes at Opposite Ends of Pacific Ocean

THE ALASKAN coast in the vicinity of the city of Cordova was shaken early Wednesday morning, Sept. 14, by an earthquake of moderate severity. This is indicated by records of seismological stations transmitted through Science Service, and interpreted by the Jesuit Seismological Association headquarters in St. Louis. The time of origin was 3:42 a. m., eastern standard time, and the epicenter was in latitude 60.8 degrees north, longitude 145.6 degrees west.

The bottom of the South Pacific Ocean, at or near Hawkes Bay, New Zealand, received a jolt from an earthquake on the morning of Thursday, Sept. 15. This was also announced by the Jesuit Seismological Association, after examination of data transmitted through Science Service.

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Something YOU HAVE MISSED

HAVE FAMOUS scientists ever told you about fascinating accomplishments in the particular fields in which they work? Wouldn't you like to sit in your home and, at the hour of your choice, listen to Dr. Millikan discuss the rise of physics, or Dr. Welch tell the story of the conquest of the tubercle bacillus? And if a point were not clear to you, wouldn't it be splendid to have that part of the talk repeated?

All these wishes may be yours—made possible by the cooperation of seven great scientists with Science Service in a pioneering venture. On subjects which fired their imaginations, each scientist made a five minute talk recorded on the new process Durium phonograph records.

In addition to the talks by Dr. Robert A. Millikan, Nobel prize winner and head of the California Institute of Technology, and Dr. William H. Welch of Johns Hopkins University, "Dean of American Medicine,"—Dr. John C. Merriam, authority on fossil animals of western America, president of the Carnegie Institution of Washington, speaks on "*The Record of the Rocks*;" Dr. Edwin G. Conklin, Princeton University biologist, one of the world's greatest authorities on life processes, on "*The Mystery of Life*;" Dr. Karl T. Compton, eminent physicist, president of the Massachusetts Institute of Technology, on "*Science and Engineering*;" Dr. Leo H. Baekeland, industrial chemist and one of America's industrial pioneers, inventor of bakelite, velox, etc., on "*Chemistry and Civilization*;" and Dr. William M. Mann, director of the National Zoological Park of the Smithsonian Institution, leading authority on animal life, on "*Our Animal Friends*."

Durium Products, Inc., made a price on a set of these seven records low enough to be attractive to purchasers. We had portraits of the scientists reproduced in photogravure process, each on a sheet of beautiful white gravure paper, size 8½"x9". On the reverse side of each picture we printed a brief biography of the scientist, together with his complete speech as recorded on the record.

Then we packed pictures and records in a compact mailing carton and found that they could be sold for \$3, postpaid. Seven recordings of seven great scientists with seven photogravure pictures, \$3. We invite your order—send \$3 to Science Service, Inc., Washington, D. C., and ask for a set of "GREAT SCIENTIST" RECORDS.

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