

GENERAL SCIENCE

Changing Science is Leaving Nothing Solid in Universe

Gen. Smuts, President of B. A. A. S. Says New Relativism Shows That Cosmos Consists Wholly of Events, Not Things

MATERIALISM, the philosophic flower of nineteenth-century "common sense" science, envisaging a solid world ruled by definite and determinable forces, is a falling god. The ground has been literally dissolved from under its feet by the new relativism of the twentieth century, which leaves nothing solid in the universe—which shows the cosmos to consist wholly of events and not of things. Science, floundering at first in this sudden bath of almost metaphysical facts, is beginning to find its feet and make itself at home in the world again.

This, in extreme condensation, is the gist of the presidential address of Gen. the Rt. Hon. J. C. Smuts, P.C., C.H., F.R.S., this year's head of the British Association for the Advancement of Science, delivered before the hundredth annual meeting of that body in London this week. The Boer soldier-statesman-scientist, once the most formidable enemy of the British Empire, but during and since the World War one of the strongest pillars of the British Commonwealth of Nations, summarized the state of science at the end of the last century, and contrasted it with the developing picture of science today.

Closed Picture of Cosmos

At its culmination, Gen. Smuts indicated, the "classic" physics presented a closed picture of the cosmos.

"The atomic view of matter was established. Ether was given a status in the physical order, which is now again being questioned in the light of the conception of space-time. New entities like energy emerged; old entities like forces disappeared; the principle of the uniformity of nature was established; the laws of motion, of conservation, and of electro-magnetism were formulated; and on their basis a closed mechanistic order of nature was constructed, forming a rigid deterministic scheme. Into this scheme it has been difficult, if not impossible, to fit entities like life and mind; and the scientific attitude has on the whole been to put them to a sus-

pense account and to await developments.

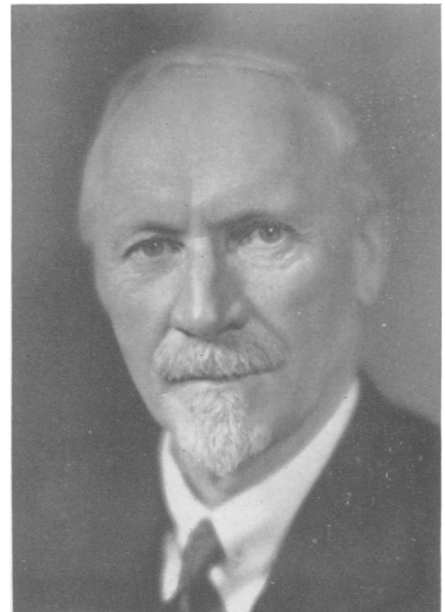
"As to the supernatural, science is or has been agnostic, if not frankly sceptical. Such, in very general terms, was the scientific outlook of the nineteenth century, which has not yet completely passed away. It will be noticed that much of the fundamental outlook of commonsense has thus survived, though clarified and purified by a closer accord with facts. This scientific view retained unimpaired and indeed stressed with a new emphasis the things of commonsense, matter, time and space, as well as all material or physical entities which are capable of observation or experimental verification.

"Nineteenth-century science is, in fact, a system of purified, glorified commonsense. Its deterministic theory certainly gave a shock to the common man's instinctive belief in free will; in most other respects it conformed to the outlook of commonsense. It is true that its practical inventions have produced the most astounding changes in our material civilization, but neither in its methods nor in its world-outlook was there anything really revolutionary."

But even at its fullest fruition, nineteenth-century science contained the seeds of ideas that would undo and supplant it. The work of such men as Faraday, Clerk Maxwell, Thomson and Rutherford paved the way for the concepts and experiments that have resulted in the revolution led by Einstein, De Sitter, Planck and the other makers of a new heaven and a new earth. Under their searching analyses the atom has dissolved into protons and electrons, and electrons now appear to be waves instead of particles—events instead of things. Time and space behave as two aspects of the same continuum, space-time. Light is not a continuous stream of waves, but is broken up into bits, the quanta.

These quanta are especially troublesome for the physicist to deal with, Gen. Smuts said.

"The world in space-time is a con-



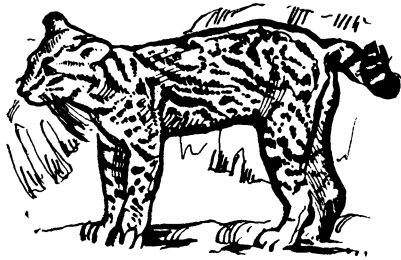
Underwood and Underwood

GENERAL J. C. SMUTS

Boer soldier-statesman-scientist and president of the British Association for the Advancement of Science

tinuum; the quantum action is a negation of continuity. Thus arises the contradiction, not only of commonsense, but apparently also of reason itself. The quantum appears to behave like a particle, but a particle out of space or time. As Sir Arthur Eddington graphically puts it: a quantum of light is large enough to fill the lens of a hundred-inch telescope, but it is also small enough to enter an atom. It may spread like a circular wave through the universe, but when it hits its mark, this cosmic wave instantaneously contracts to a point where it strikes with its full and undivided force. Space-time, therefore, does not seem to exist for the quantum, at least not in its lower multiples. Nay, more; the very hitting of its mark presents another strange puzzle, which seems to defy the principles of causation and of the uniformity of nature, and to take us into the realm of chance and probability.

"The significant thing is that this strong quantum character of the universe is not the result of theory but is an experimental fact well attested from several departments of physics. In spite of the strange Puck-like behaviour of the quantum, we should not lightly conclude, with some prominent physicists, that the universe has a skeleton in its cupboard in the shape of an irrational or chaotic factor. (*Turn to page 207*)



An American Leopard

IT WOULD STARTLE the average sportsman to run into an animal that looks like a leopard running loose on American soil, and he might well be justified in thinking he had encountered an escape from some circus menagerie. But there is a leopard-spotted cat that occasionally gets into United States territory, though its real home is much farther south, and its incursions into Texas must be regarded as the extreme northern fringe of its distribution. Nevertheless it is seen there often enough to claim inclusion in standard lists of the fauna of the United States.

The ocelot is not a leopard, of course. True leopards are Old World animals. But it is a big cat with leopard-like spots, and that is enough for all practical purposes. It does not run so large as the jaguar, though a total length of 50 inches, head to tail, and a weight of 35 pounds entitle it to plenty of respect. The jaguar, by the way, also comes up into this country from Mexico, and is occasionally seen by ranchers and hunters in Texas, New Mexico and Arizona.

Like most of the cat tribe, the ocelot sleeps all day and prowls all night, seeking what it may devour. It climbs trees as easily as its domestic counterpart, and is as fond of birds—including domestic poultry. Rabbits and other wild rodents, snakes and other reptiles, all go to make up its diet. Except for its occasional raids on the chicken-pen it should be counted an inoffensive animal, and possibly, in view of the over-grazing of range lands by rabbits, even a beneficial one.

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Some African natives believe that the souls of dead chieftains may visit their relatives in the form of snakes.

PUBLIC HEALTH

Disappearance of Diphtheria In Few Years Predicted

Latest Preventives Are so Efficient that Death Now Declared Result of Ignorance or Neglect

"A DEATH from diphtheria must be considered as a result of ignorance or neglect," Dr. W. T. Harrison, of the National Institute of Health, declared at the symposium on toxoid immunization, latest method of diphtheria prevention, during the recent meeting of the American Public Health Association, in Montreal.

Two methods of preventing diphtheria deaths now exist—one is early treatment of the disease with antitoxin; the other is prevention by immunization with toxoid, successor to toxin-antitoxin, Dr. Harrison explained.

The prevention of diphtheria by active immunization is the greatest thing in public health since Jenner's development of vaccination against smallpox," Dr. Harrison said.

He predicted that diphtheria, once the dreaded scourge of childhood, will disappear in a few more years.

Credit for the development of immunization against diphtheria goes to Dr. William H. Park, director of laboratories of the New York City Health Department, although toxoid was first introduced by Prof. G. Ramon of the Pasteur Institute in Paris.

"Dr. Park has done more than any living man to wipe out diphtheria," Dr. Harrison said. He developed toxin-antitoxin, and it is his influence on health departments, parents and physicians that has enormously reduced the diphtheria death rates in many American cities.

The diphtheria bacillus produces a poison or toxin which, in massive amounts, causes illness and death. Antitoxin is an antidote to the diphtheria poison and is used to treat cases of the disease. Toxin-antitoxin, on the other hand, is toxin largely neutralized by antitoxin. When it is introduced into the body, the antitoxin gradually splits off, leaving more and more of the toxin. These very small doses of toxin have the effect of raising the body's resistance to the disease.

Toxin-antitoxin has the disadvantage that when it has been frozen for a time

it may become inert, or, on the other hand, may become toxic. This uncertainty is entirely absent in toxoid. Toxoid is toxin to which a small amount of the common disinfectant formalin has been added, and which is then kept at a temperature of 100 to 102 degrees Fahrenheit for from three to six weeks. During this time it loses all its toxicity, but retains its immunizing properties.

Toxoid is entirely non-poisonous and absolutely harmless, Dr. Harrison emphasized. No case of injury has been known to follow its use. Neither is there any danger of serum sickness, as it contains no horse or other serum. It is given in courses of two or three treatments. After the first course, nine-tenths of the children become completely immune. Toxoid is twenty to thirty per cent. more efficient, even when only two doses are given, than is toxin-antitoxin, experiments have shown.

Toxoid plus alum gives the best results, Dr. Park and his associate, Dr. May C. Schroeder, reported. Toxoid should be used for pre-school children. In a few older children and adults, toxoid causes a marked local reaction.

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Science Leaves Nothing Solid

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"Our microscopic concepts may not fit this ultra-microscopic world of the quantum. And our best hopes for the future are founded on the working out of a new system of concepts and laws suited to this new world that has swum into the ken of science. The rapid development of wave mechanics in the last four years seems to have brought us within sight of this ideal, and we are beginning to discern a new kind of order in the microscopic elements of the world, very different from any type of law hitherto imagined in science, but none the less a rational order capable of mathematical formulation . . . The complete recasting of many of our categories of experience and thought may ultimately be involved."

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