

GENERAL SCIENCE

Faith Important in Science As Intuition and Reason

Retiring President of American Association Gives The Articles of His Personal Scientific Faith

FAITH is as important in the pursuit of scientific knowledge as intuition and reason, while "today the significance of science as a principal source of revelation is almost universally recognized."

This was the essence of the message of Dean George D. Birkhoff, Harvard's leading mathematician. As retiring president of the American Association for the Advancement of Science, Dean Birkhoff delivered the principal address.

"In the daring effort of the scientist to extend knowledge as far as possible," Dean Birkhoff declared, "there arises an aura of faith. It is this spontaneous faith that furnishes the most powerful incentive and is the best guide to further progress."

By faith Dean Birkhoff explained that he means "those heuristically valuable, more general points of view, which are beyond reason, and sometimes in apparent contradiction with one another, but which to the individual concerned seem of supreme importance as he endeavors to give his conclusions the widest possible scope."

Making a strong plea for an essentially religious attitude toward the problems of science and society, Dean Birkhoff announced the articles of his personal 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 goodwill in all human relations is shown by their mighty beneficent effect upon the individual and society.

Anyone is free to agree or disagree with these articles of faith, Dean Birkhoff emphasized, because they are not verifiable experimentally or strictly demonstrable. In opposition to his belief that the levels of knowledge are to be taken as equally real, he states that there might be set the opposing belief that every fact

is ultimately expressible in purely physical terms.

Dean Birkhoff presented to his scientific audience a "mind-nature spectrum," containing five ascending levels, mathematical, physical, biological, psychological and social. Each of these levels has its appropriate special language, Dean Birkhoff explained, and the basic concepts are number at the mathematical level, matter at the physical level, organism at the biological level, mind at the psychological level, and society at the social level.

"If we choose to select one of these as somehow more real than the others, a great distortion arises in our point of view," he said. "For instance, if we regard the physical level as the most fundamental, we become materialists. But why make such an unnecessary choice? The languages of the various levels are essentially independent of one another, and the observed laws are best expressed in their own natural terms. Why mix up the levels of knowledge unnaturally? Does it clarify our idea of social justice to try to explain it in terms of the re-

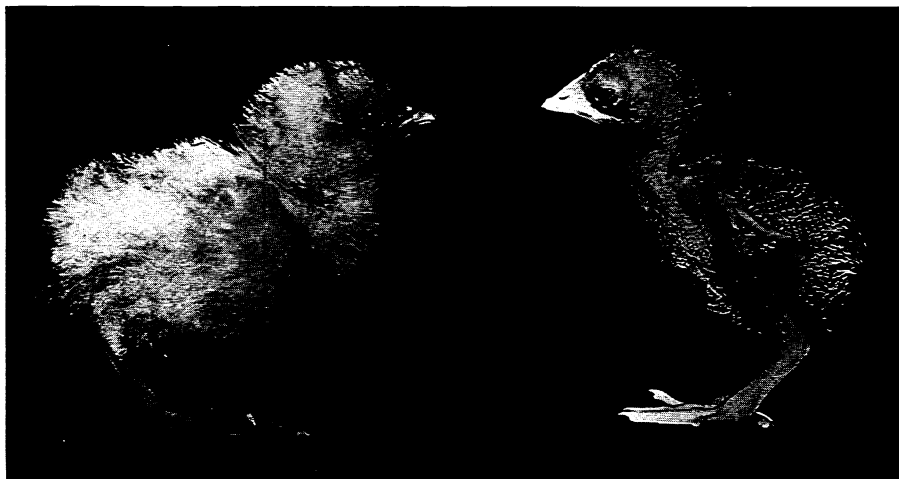
actions between protons and electrons in the brain?"

As an example of the intimate relationship between philosophical-scientific viewpoints and actual advances in theoretical physics, Dean Birkhoff cited Einstein's gravitational theory of 1915.

He explained that Einstein took as his starting point the reasonable hypotheses that matter must condition space and time, and that, in parts of space remote from matter, elementary particles move with uniform velocity in a straight line. Einstein arrived at his field equations as the most elegant mathematical embodiment of these ideas. Thus there was obtained a quasi-geometrical theory of gravitation which in certain respects is more natural than the celebrated theory of Newton, while the predicted differences although excessively minute are in favor of the new theory. But Dean Birkhoff believes that Einstein's theory cannot be regarded as true in any absolute sense since it gives us at best a partial, highly idealized view of the physical universe.

The origin of life may be explained by the fact that chemical experiments upon large organic molecules such as are present in disease viruses, seem to indicate "an innate hospitality of actual matter toward the evolution of the living organism," Dean Birkhoff explained. But this, he explained, "can scarcely be called mechanistic." But he does believe it seems possible that we are on the verge of further refinements in our concept of matter.

A plea for further unification of the



NAKED CHICKENS

Oddly undressed chicks like the one at the left have appeared in a flock studied by Drs. F. B. Hutt and P. D. Sturkie of Cornell University and reported on in the Journal of Heredity. During adolescence they become even naked. Only at maturity do they grow a few feathers.

whole scientific world to promote better understanding among men was voiced by Dean Birkhoff in closing his address.

Nervous Breakdown Cause

DIFFICULT problems will not drive you crazy, even if they are completely unsolvable, provided you are not forced to find an answer. Men suffer from nervous breakdown when they are driven by circumstances to take some action but still can find no way to turn, it was concluded by Dr. Norman R. F. Maier, of the University of Michigan from research reported to the American Association.

"Pregnancy and the conflicts arising from sin contribute greatly to neurotic behavior by leaving no avenue for behavior and yet requiring that something be done," Dr. Maier said.

On the other hand, going to the electric chair, while it may produce tensions, does not produce neurosis because the individual knows just what he must do.

Dr. Maier's experiments were conducted with rats that had been taught by reward and harmless punishment to distinguish between two cards. Then, instead of being permitted a choice, the animal was shown only one of the cards and yet was forced to act by a blast of air. At sight of the "punishment" card, the rat might resist action for as long as 15 minutes before he would jump.

Neurotic symptoms resulted. The animals would tear out of the apparatus, run in circles on the floor, show intense tics, and then varying degrees of coma.

The cure for human patients, Dr. Maier indicated, seems to lie in the direction of finding a way for the patient to act.

Maze Test Clue to Learning

THREADING with a pencil a complicated maze, 60 human subjects have led to a revision in the psychologist's general theories of learning.

The experiment was described by Dr. John A. McGeoch of Wesleyan University.

When his subjects had once found the correct path that would lead them successfully through the maze, they could repeat it at will, but their individual movements in threading it might vary with each trip.

The learning, Dr. McGeoch concludes, was not of a stereotyped set of movements. Instead, the student learned how

to cover a general route and reach a certain goal.

A similar situation perhaps exists when you go into a strange town and learn the location of the post office. You may then be able to reach it by traveling any of a number of streets.

Psychologists, in their thinking about learning, Dr. McGeoch indicated, must

take into consideration a factor which is in the nature of a "set", or readiness, to go in a certain direction at a certain point in the activity regardless of the specific acts along the way.

"We know little of its specific character," he said, "but as a useful construct it seems to be required."

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ASTRONOMY—PHYSICS

Nova Star Splits Into Three; May Be Creation of New World

Two Parts Are On Their Way Rushing Out Into Interstellar Space; Observed in South Africa

THROUGH telescopes in Java and in South Africa astronomers are now watching a giant stellar explosion which may be producing new worlds.

This exploding star, known as Nova Pictoris to astronomers, has been split up into three sections which are flying apart at speeds of over a million miles an hour.

Calculations of the energies needed to bring about this stellar explosion were reported to the American Physical Society in Washington, D. C., by Dr. Ross Gunn of the U. S. Naval Research Laboratory.

Through telescopes in the southern

hemisphere Nova Pictoris looks like three tiny pin-points of light close together. The largest of the three parts has a mass 86 per cent. of that of the sun and the two smaller parts have masses 34 and 30 per cent. respectively of the sun's mass.

At last measurement the small parts were about three light years away from the larger part and moving rapidly to still greater distances. A light year is the distance light travelling at 186,000 miles a second will travel in a year. In distance a light year amounts to 6,580,000,000,000 miles.

The speed of recession of the small



ARCHAEOLOGICAL JIGSAW

In the grave of Queen Aase at Oseberg, Norway, were found 1,068 pieces like these. Prof. A. W. Brogger tells how University of Oslo scientists dug the pieces out from where they had been since 850 A.D. and boiled each scrap in alum and lacquered them with linseed oil to prevent shrinkage.