GENERAL SCIENCE

Harvard Conference Hears Scientists From Many Fields

How Embryonic Development is Determined, Cause of Hayfever, Nature of Cosmic Rays Are Some of Topics

Rarely is it possible to listen to such an assemblage of notable men of science as recently gathered at Cambridge, Mass. See SNL, Sept. 12, for the first installment of highlights of this conference.

EMBRYOLOGY

Prof. Hans Spemann—Chemical Organizator

CHEMICAL commanders in the bodies of embryo animals, giving orders that are received and obeyed by the developing parts, were described by Prof. Hans Spemann of the University of Freiburg, Nobel prizewinner.

The mode of action of these commanders is known, and the places where they can be found during bodily development; but their exact identity remains a secret. Nobody has ever got one out, whole and separate, and made a complete chemical analysis of it—Prof. Spemann is still digging at that part of the problem.

When embryonic development begins, with the fertilized egg cell, there forms first a hollow globe of cells, with a tiny opening at one side, the blastopore. At this stage therefore there is neither head nor tail to the animal, nor much of anything to suggest where these regions and the other organs will eventually be.

But Prof. Spemann found that if he took a bit of the lip of the blastopore from one of these early-stage embryos, and transplanted it onto another embryo at the same stage, this transplanted bit determined a head-to-tail body axis. Since the second embryo already had its own blastopore, there were two axes, and a double embryo developed.

Prof. Spemann gave the name "organizator" to the unknown substance or influence emanating from these tiny tissue transplants. He found that there were other critical points of growth, in later development, that possessed organizators of their own, influencing the whole embryo, or limiting their effects to particular regions or organs as they formed. He was able to produce organizator reactions without transplanted tissues, using only extracts from various kinds of animal material or even chemically pure organic compounds. There is competition or interplay between these various regional organizators, and this determines development.

The obedience of the developing animal parts to the organizators' orders is not blind and slavish. The growing organs have something to say on their own behalf. Thus, if a bit of skin is transplanted to where the brain is to form, the skin-tissue will change its nature and form brain-stuff; but it will be the brain of the kind of animal it came from, not of the animal species into which it was planted. Similarly, if the side of a toad embryo head is planted onto the head of a newt embryo, it will grow fast in its new place, but will produce jaws and other head parts of the toad type, not those of a newt. That is to say, whatever command is issued by the inductors of the host, the response is executed by the transplanted tissue in the manner provided by the inheritance of its own species.

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PHYSIOLOGY

Sir Joseph Barcroft—Why We Breathe

TAPPING an embryonic sheep on its snout with a glass rod furnished a group of scientists with an explanation of the rhythm of breathing. The experiments and the way in which they explain the fundamental nature of this breathing rhythm were described by Sir Joseph Barcroft, Cambridge University professor of physiology, at the Harvard Tercentenary celebration.

Scientists have considered three different explanations for the rhythmic in-and-out of air which they call respiration but which is breathing to most of us. According to one explanation, breathing in starts a message to the brain which checks the inhaling phase and starts the exhaling phase of breathing. This exhaling, in turn, sends a message to the brain that checks the exhaling and starts the inhaling phase.

According to another explanation, there is a continual urge in the central nervous system, which includes the brain, to breath in, but the act of inspiring sets up sensory impulses which check the effort. The lung then passively returns to its unexpanded condition, which takes care of the exhaling. According to this explanation, the brain and central nervous system is the essential seat of breathing and does not merely act as a telephone exchange.

Central Nervous System

The third view is that breathing is due to rhythmic activity of the central nervous system. The sheep embryo experiments, undertaken with another purpose, unexpectedly furnished support for this view, Sir Joseph said. Sir Joseph and his associates were seeking the solution to another scientific problem, that of how the first movements of the unborn young of mammals start. Do the ordinary movements of legs and arms and other parts of the body arise from generalized mass movements of the whole body, or do the localized movements develop into generalized motions all over the body? Sir Joseph and associates sought the answer by studying the large and slowly growing embryo of the sheep. They found that the mass movement is built up from localized movements and when built up can be resolved into localized movements which have definite significance and purpose.

A stimulus such as tapping the sheep's snout with a fine glass rod starts a localized movement of the snout and head. Later this stimulus sets up rhythmic movements through the whole body, mass movements which start with the local stimulus to the snout. At a still later stage, these rhythmical mass movements break down and more localized ones appear in response to the stimulus, such as straightening and stretching of tail and limbs. At first these stretching movements are spasmodic, later they become rhythmic. At a still later stage, the lamb fetus is so lively that the rhythmic movements are practically constant and the fetus looks like an ordinary animal breathing naturally. A stimulus at this stage produces more energetic rhythmic movements that give the appearance of an animal out of breath as the result of effort.

The inference is that these rhythmic body movements, which may be elicited by a stimulus to the sensory nerves, show a rhythmic activity of the nervous system which would account for the

rhythm of breathing as well as for rhythm in other body activities.

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PHYSIOLOGY

Dr. Karl Landsteiner— Antibodies and Sneezes

THE SNEEZES of the hayfever sufferer, the hives of the person who is upset by eating fish, the rash or more severe reaction that follows taking a drug in persons hypersensitive to it, are all signs of a "very comprehensive and remarkable biologic phenomenon," Dr. Karl Landsteiner of the Rockefeller Institute for Medical Research told fellow scientists at the Harvard Tercentenary celebration.

Best known for his discovery of the blood groups, Dr. Landsteiner has investigated other features of blood, such as its mysterious antibodies which fight invading disease germs. From that he has branched over into a study of the body mechanisms for resisting other foreign substances, particularly chemicals taken into the body as drugs.

The antibodies, Dr. Landsteiner believes, play a defensive role not only against disease germs but in allergies, such as hayfever, and in drug idiosyncrasies, although scientists have not yet been able to demonstrate their presence in all cases of these conditions.

By means of these antibodies, circulating in the blood or fixed in body tissues, the body adapts itself to various chemical agents.

"If successful, this mechanism guards against infectious disease," Dr. Landsteiner said, "but when it miscarries it induces sensitivity to exceedingly small quantities of proteins or simple chemical compounds."

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CHEMISTRY

Prof. August Krogh— Isotopes a Tool

CHEMICAL isotopes, the seldom-met "twins" of ordinary atoms, are being used in Denmark to trace the course of water, minerals, and organic substances through the physiological processes of plant and animal bodies. Some of the results were revealed for the first time, by Prof. August Krogh of the University of Copenhagen, speaking before the Harvard Tercentenary Conference.

An isotope might be defined as a form of a chemical element that behaves chemically like its better known twin, but is different enough on the physical side to permit it to be detected by suitable physical means. Thus, it is possible to produce a form of phosphorus distinguished by being radioactive, whereas ordinary phosphorus is not. Or, the famous heavy hydrogen is twice as heavy as ordinary hydrogen, so that heavy water containing it can be detected by weighing it.

Prof. Krogh and his associates have been giving isotopes of various nutrient elements to plants and animals, and afterwards analyzing the tissues from various parts, to find out where the isotopes went. They found, among other things, that radioactive phosphorus traveled around plants a good deal more rapidly than had previously been thought to be the case. Also, radioactive phosphorus turned up in the dentine of teeth, which has always been thought to be pretty well cut off from the rest of the body.

Another series of experiments, using heavy water, showed that water gets around through the body of an animal quite rapidly, once it enters, and that any given quantity of water comes to be distributed pretty evenly throughout the whole body. Water-dwelling animal forms were shown to be capable of absorbing water through their gills, and also through their skins when these were not too thick.

Prof. Krogh stated his belief that of all types of isotopes, the radioactive ones would prove most useful in physiological studies because it is so easy to detect them. He said that powerful apparatus is now being erected in his laboratory for the preparation of new kinds of radioactive elements.

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CHEMISTRY

Prof. The Svedberg— The Protein Molecule

FROM another Baltic country came a report on investigations into the size and makeup of the protein molecule, among the largest and most complex of atomic aggregates. Prof. The Svedberg of the University of Upsala, Sweden, told of methods and instruments evolved in his laboratory, which include an ultra-centrifuge that can whirl solutions at a rate of from sixty to seventy thousand revolutions a minute. This separates out intimately mixed things, as cream is separated from milk in a cream separator, and permits physical and chemical examinations to be made of the parts.

Prof. Svedberg's results confirm the idea previously held, that protein molecules are relatively enormous, containing tens or even hundreds of thousands of atoms each, as against a mere half-dozen or dozen in common inorganic compounds, or a few scores or hundreds in the simpler organic molecules. Also, it was found that these huge molecules were not built up single atom by atom, but that whole blocks of atoms were manipulated at a time. That is, they were not put together a brick at a time, like a mason erecting a wall, but more like bolting together the whole sides of a knock-down house.

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MEDICINE

Dr. Kiyoshi Shiga— Dysentery Unconquered

BACILLARY dysentery, one of the great health hazards of tropical regions, which occasionally reaches into more northern parts, is still unconquered, scientists at Harvard's Tercentenary were told by Dr. Kiyoshi Shiga of the Kitasato Institute, Tokyo.

Dr. Shiga more than thirty years ago discovered the bacillus or germ that causes dysentery. Now he told with keen regret how, in spite of this discovery and a lifetime of subsequent research, the disease still defies the efforts of himself and other scientists to wipe it out.

In the years that passed since the epochal discovery of Dr. Shiga's youth, much new knowledge has been gained about the disease, he related. Almost a hundred different strains of germs that cause the disease have been discovered. The poison produced by the germ has been studied and found to rank next to the toxins of tetanus (lockjaw) and diphtheria in strength. An antitoxin has been prepared and found effective in mild and medium cases, but less effective in severe cases.

Carriers of the bacillus present an important problem, as they do in typhoid fever. Carriers of one type of dysentery bacillus have decreased, but carriers of another type have increased. The decrease Dr. Shiga attributes to the fact that another bacillus normally present in the intestinal tract has been able to overcome the Shiga type of dysentery bacillus, but has become accustomed to living side by side with the other type which consequently still flourishes.

"Suppresssion of carriers may be an important problem but suppression of the cases is more feasible," Dr. Shiga