GENERAL SCIENCE

Private Research Best

Annual report of Carnegie Institution of Washington notes progress in astronomy, formation of earth's rocks in the laboratory, photosynthesis and human embryology.

➤ THE GREAT need for fundamental scientific research can best be met by privately endowed research institutions, Dr. Vannevar Bush, president of the Carnegie Institution of Washington, said in his annual report to the Institution's trustees.

Recent trends in research projects financed by the government and foundations at universities have led some to the mistaken conclusion that research institutions are "obsolescent," Dr. Bush commented.

In the field of fundamental research, "the research institution is paramount," he declared.

Dr. Bush pointed out that research institutions were not necessarily isolated and could take advantage of the ideas of young scientists. Isolation and scientific fixity can be successfully avoided by the research institution, he said.

During the war the federal government entered the field of scientific research by supporting research projects. This lead has been partly followed by the foundations. Project research, however, is "far better adapted to applied research than to fundamental research," Dr. Bush said.

"The foundations here have to some extent missed an opportunity," he continued. "As the government entered strongly into scientific research, they moved out. If they had moved into basic research, they might have preserved a balance."

The research institution gathers scientists of genius who can work with other scientists in "a broad program for progress," Dr. Bush said. This kind of "team" research, free from the distractions of the university, is best done by private research institutions, he declared.

Dr. Bush summarized the research accomplishments of the Institution in the past year. He called attention to studies on the magnetic field of the sun, the formation of granite rocks, the chemical aspects of growing bacteria, photosynthesis and human embryology.

Earliest Human Embryos

Discovery of the earliest human twin embryos scientists have so far seen was reported by Dr. George W. Corner, director of the Institution's department of embryology located at Baltimore.

These earliest beginnings of human twins are 17 days old, counting from the time of conception. They have been identified by Dr. Chester H. Heuser as identical twins.

They are particularly valuable, Dr. Corner points out, because they give indisputable proof that single egg twins, or identical twins, can develop in one of the ways that scientists have believed possible on the evidence of later stages of twin development.

This is by formation inside a single blastocyst of two embryonic areas, each of which becomes a separate embryo. The blastocyst is the stage of the embryo which follows cleavage, when the cells are arranged in a single layer to form a hollow sphere.

Algae-Enriched Foods

Algae rich in protein can be added to soups, breads, jelly rolls, noodles and ice cream in significant amounts and the foods still are pleasant to eat.

Chlorella, the one-celled plant, is being widely investigated as a new food source, but little of it has actually been eaten. The Institution reports taste tests of a Japan-produced *Chlorella ellipsoidea* to some foods at its Stanford, Calif., department of plant biology.

"Highly palatable" was the verdict of the testers who had Japanese, American and European backgrounds. Prof. and Mrs. Hiroshi Tamiya, who made the tests, found the foods were improved in taste and the enriched breads and ice cream were particularly good.

Direct addition of *Chlorella* to food seems feasible, the investigators concluded.

Jupiter's Atmosphere

Jupiter's atmosphere is made up largely of hydrogen and helium, not methane and ammonia as was previously thought.

Dr. William A. Baum of the Mount Wilson and Palomar Observatories and Dr. A. D. Code of the Washburn Observatory, Madison, Wis., have obtained the first direct observational evidence concerning what gases compose Jupiter's atmosphere. These are hydrogen and helium, they found from light curves of the gases composing the outer layers of Jupiter's atmosphere. The heavier gases, such as nitrogen and oxygen, that make up the earth's atmosphere are therefore believed to be almost absent on Jupiter.

Drs. Baum and Code made their observations when Jupiter eclipsed a bright star, Sigma Arietis, noting the rate at which light from the star was dimmed, then finally extinguished by the planet. To catch the star's disappearance with the 60-inch telescope, they used a photomultiplier, a sensitive instrument that steps up the star's faint light to record it electrically.

Drs. Edison Pettit and Robert S. Richardson, also of the Mount Wilson and Palomar Observatories, took motion pictures of the star's eclipse at the time time. They found "remarkable variations" in the brightness of the star about 50 seconds before it finally disappeared. These were due, they believe, to turbulence in Jupiter's atmosphere. Such marked fluctuations were also found with the photomultiplier.

The dimming and gradual disappearance were caused by the spreading of the star's

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light as it was refracted by gases in Jupiter's outer atmosphere. A dense atmosphere would have caused the starlight to dim rather rapidly, but the actual observations showed that it faded out quite gradually.

The figure of 3.3 for the mean molecular weight of Jupiter's atmosphere agrees substantially with an estimate based on a study of Uranus and Neptune that showed that helium is about three times more abundant than hydrogen on those planets. If Jupiter had the same ratio, its mean molecular weight would be an estimated 3.5.

The findings of the two astronomers, at the present time, can be no more specific than that helium and hydrogen account for most of Jupiter's atmosphere. They do not indicate how much of each gas is present or what other elements may exist there.

Bacterial Cell Adapts

Flexibility in the way a bacterial cell can adapt its life cycle to changing conditions is the secret of its survival. This conclusion is reported from researches carried out at the Carnegie Institution of Washington's department of terrestrial magnetism.

Usually the bacterium *E. coli* builds up amino acids according to the cycle discovered by Dr. Hans Adolf Krebs, Nobelist in medicine of this year. But under certain circumstances the organism alters the chemistry of this reaction. Instead of building up amino acids, the bacterium changes the Krebs cycle to a mechanism of oxidation. These changes have been followed by feeding the bacterial colony substances containing radioactive carbon.

Ancient Maya Religion

Excavation at Mayapan, ancient city of the Maya Indians in Mexico, indicates the possibility that Maya civilization was turning from public religion to a more private worship before the Spanish Conquest, Dr. H. E. D. Pollock, director of the Institution's department of archaeology, reports.

Evidence of the religious change includes fragments of human-effigy incense burners, apparently household idols, found in the shrine room of an excavated dwelling. There is also evidence that dwellings were encroaching on ceremonial areas during the last period of the city, upon which excavation began this year.

A study of grave sites in the area, however, shows that human sacrifice was still practiced in the late period of the city. Spanish observers writing at the time of the conquest also support the theory that Maya religious practices were changing during the last period of the civilization.

Dr. Pollock said that the work at the site has not advanced enough yet to determine the growth and development of the city plan. All the buildings studied so far seem to belong to the same cultural period.

The Institution will make a thorough investigation of one or more examples of each important type of building found in the city. The scientists hope to be able to describe the domestic economy and way of life of the Maya people following the completion of the archaeological work.

Saving New Babies

Findings made with X-ray motion pictures before and after birth are giving doctors new knowledge for saving babies threatened by death immediately after birth.

The findings were made by Dr. S. R. M. Reynolds of the Carnegie Institution of Washington's department of embryology, Baltimore, and, at Dr. Reynolds' instigation, by Drs. G. M. Ardran, G. S. Dawes, M. M. L. Prichard and D. G. Wyatt of Oxford University and the Nuffield Institute of Medical Research in England.

The X-ray movies showed, contrary to expectation, that before breathing begins there is virtually no circulation of blood through the lungs of the unborn infant. The movies were made of unborn lambs, but the findings apparently hold true for unborn human babies also.

For the first time, in the Carnegie and Oxford research, blood pressure was measured in two major arteries, the pulmonary trunk and aorta, in the unborn infant, and at each end of the ductus arteriosus. This ductus is the channel from the lung artery to the aorta, main artery from the heart. It normally closes at birth and when it fails to do so, the "blue baby" condition results.

Before birth, blood flows through this channel under considerable pressure, the scientists discovered. When the infant begins to breathe, the blood is immediately diverted from the channel into the lung arteries. As the lungs expand, the volume rate of flow through them increases almost five-fold.

At this time, the pressure in the main artery to the lungs drops to a low point. During the first few minutes after this change, the general blood pressure also falls, apparently because of the transfer to the lungs of a significant portion of the total blood of the infant.

This short, temporary general fall of blood pressure at the start of breathing in the new baby has not previously been known. If overly large, it may be dangerous. Discovery of this whole situation in the baby's circulation has already helped doctors save newborn babies.

The changes of pressure and blood flow, it was also found, have a bearing on the closing of the ductus arteriosus and, therefore, on prevention or development of the "blue baby" condition. Blood is diverted into the lungs because of lowered resistance to blood flow in them. This diversion of blood and the accompanying fall in blood pressure in the ductus apparently allow the channel to constrict and shorten through action of the elastic fibers and smooth muscle cells in its walls. Thus it is obliterated and the "blue baby" condition avoided.

Make Earth's Rocks

Progress in learning how the rocks of the earth were formed has continued in the geophysical laboratory, the annual report revealed. Many minerals have been duplicated in high-pressure furnaces, proving the conditions under which they must have formed in the earth.

Granite, which contains five of the six most common kinds of minerals in the earth's crust, has been proved to have cooled from a magma of melted rock-making material. Studies on many types of such material show that granite is the first product to form from such a magma. It will crystallize out of an alkaline liquid containing a high percentage of soda and potash.

Water can be injected into the experimental furnace in which these synthetic minerals are made, by an improvement which the scientists have added. With this equipment, it has been found that water in the form of a gas can, under the pressures found far down in the earth's crust, dissolve up to 33% silica, the main rock-forming element.

Such studies are deciding the old question of how the rocks were formed in favor of cooling conditions from hot, volcanic-like melts, instead of a reworking of older sediments.

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MEDICINE

Anti-Germ Mechanism In Mid-Digestive Tract

➤ EXISTENCE OF an antibacterial mechanism in the middle part of man's digestive tract, or small intestine, is reported by Miss Judith Cregan and Drs. E. S. Dunlop and Nancy J. Hayward of the University of Melbourne, Australia, and the Royal Melbourne Hospital in the *British Medical Journal* (Dec. 5).

This anti-germ, or antibacteria, mechanism is independent of the germicidal barrier of the stomach, they found from studies on 22 patients undergoing stomach operations.

Failure of scientists in the past to recognize that there are two such independent mechanisms, and that the stomach mechanism may be defective but the small intestine one intact, has led to much misconception, the Australian scientists point out.

For example, it has been suggested that vitamin B deficiencies arise in patients who have had their stomachs removed, and in those with sprue, pernicious anemia and pellagra, because bacteria that get by the missing or defective stomach barrier in such patients invade the small intestine and deprive the patient of vitamins.

This theory, the Australians point out, has no sound foundation unless or until it can be shown that the small intestine germ barrier is also defective in such patients.

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