

## GENERAL SCIENCE

# Royal Society, 1660-1960

Founded by King Charles II, the Royal Society celebrated its tercentenary with a nine-day meeting in London attended by scientists from all over the world.

Reports by Tove Neville from London

## BIOCHEMISTRY

## Energy-Rich Booster Chemicals Recharge Tired Nerves, Help Them Recover

NORMAL NERVE FIBERS, which operate somewhat like the transmission system in an automobile and can run down like a tired battery, are kept going by a built-in recharger, scientists attending the tercentenary celebration of the Royal Society in London were told.

Dr. A. L. Hodgkin, research professor of the Royal Society and fellow of Trinity College at Cambridge University, said it has recently been possible to obtain evidence about the source of energy for the "ionic pump," which starts a tired nerve fiber on its way to recovery.

Most of the research has been done on the whopper-sized nerve fibers of the squid, a ten-armed relative of the octopus. In a fully grown Atlantic squid, *Loligo forbesi*, the fibers are four to eight inches long and one twenty-fifth of an inch in diameter.

For some time physicists and physiologists working on the problem of nervous transmission have known that the inside of the nerve fiber usually has a high concentration of potassium ion. Outside the thin fiber membrane is a high concentration of sodium ion.

When an electrical, or nerve, impulse

comes along, some of these ions trade places through the membrane. Each exchange takes place in one millisecond, but the time required for the ions to return to their proper places after the impulse passes is relatively long. If too many impulses must be transmitted before the ions are back in their resting places, the nerve would become tired.

Without help the fiber cannot get the ions back where they belong. In poisoned or fatigued isolated squid nerve, Dr. Hodgkin said, the needed recharge comes in the form of energy-rich, phosphate chemicals—arginine phosphate and ATP, adenosine triphosphate. Either of these will bring temporary recovery to a fiber that has been poisoned, or essentially worn out, with cyanide. A large dose of arginine phosphate makes the fiber almost normal.

What happens is that the booster chemicals push the sodium ions back outside the fiber membrane and the fiber recovers. Tracer studies have shown that it takes one or two molecules of arginine phosphate to eject a single sodium ion, Dr. Hodgkin reported.

• Science News Letter, 78:67 July 30, 1960

## PHYSICS

## Studies of the Tracks of Cosmic Rays Will Provide Valuable Information

PREPARATIONS are now being made to capture tracks of cosmic rays with energies up to a million billion electron volts at 100,000-foot altitudes, Prof. C. F. Powell, Nobel Prize winner of the University of Bristol, told scientists at the tercentenary meeting of the Royal Society.

He said an expedition, supported by the Research Council of NATO, will send an emulsion "sandwiched" with layers of tungsten up for 40 hours' study of cosmic ray particles from a balloon in 1961. The presence of the tungsten causes the production of large numbers of electrons that appear as bundles of tracks visible to the unaided eye. The studies of the tracks give valuable information about neutral particles that could not be got by any other means.

Prof. Powell said that most elementary particles have been discovered by experiments with cosmic radiation. Later, the properties of particles and their behavior were investigated by beaming particles at a target in large atom smashers.

A second way of studying the particles is to make use of the protons and other nuclei of great energy that enter the earth's atmosphere as cosmic radiation.

The great advantage of sending detecting apparatus to high altitudes is that the particles have not been modified by passage through the atmosphere, said Prof. Powell.

For such experiments photographic emulsions are used to record the tracks of particles with great advantages. The emulsion stays sensitive and no extra apparatus is needed to make exposures. The observations allow very detailed study of individual nuclear collisions by the protons.

Several international balloon flights carrying "stacks" of emulsion to high altitudes have been undertaken, the first two from Sardinia in 1953 and 1955, Prof. Powell reported. He said many European scientists participated in these expeditions.

The latest experiment in this field was a result of international collaboration. A stack of pure emulsion was recently

launched by balloon from the United States aircraft carrier, *Valley Forge*, in the Caribbean.

The balloon rose 115,000 feet and was recovered after about 14 hours flight. A second flight is being attempted in Texas, he said.

• Science News Letter, 78:67 July 30, 1960

## TECHNOLOGY

## Nuclear Power Necessary In Britain by 1970's

THE COST OF ELECTRICITY from the atom must be cut to help Britain meet fuel shortages expected by the early 1970's, Sir Christopher Hinton, chairman of the country's Central Electricity Generating Board, told the Royal Society at its tercentenary celebration in London.

Nuclear power will be cheaper when higher temperatures can be achieved, Sir Christopher said. Advances in technology are still bringing down the cost of conventional power. Therefore, nuclear power will have to compete with falling costs to break even and then go below cost of currently used fuels, he said.

That nuclear power is not already as cheap as conventional power is due to problems within the nuclear generators.

The development of magnesium alloys (magnox) made nuclear power generation possible, Sir Christopher said. However, further advance cannot be expected until a new material can be found. Use of stainless steel or beryllium is not promising because the cost of fuel elements would exceed that of magnox.

Sir Christopher said one engineering problem in nuclear generator design deals with the large pressure shells, made from plates of thicknesses so great that possibilities for rolling and cross-rolling of the material are minimized. There is a danger of casting defects and coarse grain in the steel for this reason.

Besides, welding of these thick plates is not easy and brittle fracture, increased by neutron irradiation, makes the problems even greater.

Past experience of reactor development has led the British Atomic Energy Authority to design the advanced graphite reactor (A.G.R.), Sir Christopher said.

It is estimated that the capital cost of the first industrial reactors of the A.G.R. type will run at about \$250 per kilowatt hour.

• Science News Letter, 78:67 July 30, 1960

## GENERAL SCIENCE

## Faith in Science Urged Despite Dangers

DO NOT DISRUPT YOUR WORK by worry over a devastating nuclear war or over world starvation from the population explosion. Have faith in science.

This is the advice given scientists by Sir Cyril Hinshelwood in his address as president of the Royal Society at its tercentenary meeting.

(Continued on p. 79)

## Faith in Science Urged

(Continued from p. 67)

Faith in science, Sir Cyril told his colleagues, is not incompatible with other kinds of faith. He said that there seems to be no inconsistency in believing that scientific knowledge is itself one of the great instruments of higher ends.

Sir Cyril predicted that in the future a great upheaval of ideas may well cause a complete re-orientation of science in relation to philosophy and to the conceptions of possible worlds.

He said the Royal Society's responsibility is to work as a smaller creative community within the larger. Its members have responsibility to mankind in general as well as to their native country and the Royal Society.

The most original minds, Sir Cyril said, are those who continue the work done by their predecessors and whose own work is fulfilled by their successors.

He said that this trait is true not only of genius but of all men. This continuity is the stuff of history and is what the Royal Society honors at its tercentenary celebration.

• Science News Letter, 78:67 July 30, 1960

## Do You Know

Americans are expected to draw perhaps 12 billion *checks* for all purposes in 1960—double the volume of ten years ago.

Of the 573,000 tons of *natural rubber* imported by the United States in 1959, 185,000 tons came from Malaya and 158,000 tons from Indonesia.

A recent census showed 36 unprovoked attacks on swimmers by *sharks* in 1959, 13 of which resulted in death.

The Geological Survey plans to conduct an inventory of *water use* in the United States in 1960.

The Soviet Union is currently graduating 90,000 *engineers* annually, double the number of United States engineering graduates.

One birth in 87 produces *twins*, and, among twins, only one set in three is identical.

## Questions

ANTHROPOLOGY—Who were the two most famous lawyers in the Scopes trial? p. 69.

ASTRONOMY—What is the diameter of the white dots found in a sunspot? p. 66.

GENERAL SCIENCE—What are three important results of space research? p. 70.

Photographs: Cover and p. 74, UNESCO/Laurenza; p. 66, National Science Foundation; p. 69, U. S. Naval Ordnance Laboratory, White Oak; p. 71, University of California, L.A.; p. 80, Pyro Plastics Corporation.

## METALLURGY

# Iron Rust Theory Given

A BASIC EXPLANATION for the rusting of iron, one of the most destructive and wasteful chemical reactions known, has been found by Dr. Earl A. Gulbransen and T. P. Copan at Westinghouse Research Laboratories, Pittsburgh, Pa.

Iron corrosion is believed to waste up to seven billion dollars annually in the United States alone. Eighty million dollars alone are spent by automobile owners replacing mufflers each year.

The new theory suggests that hydrogen ions are the culprit. The hydrogen ions come from water vapor, which must be present if iron rusts very much at room temperature. The tiny hydrogen particles are thought to penetrate the iron and enlarge the sites at which oxygen normally combines with the metal.

Previous explanation for iron corrosion was that it is an electrochemical reaction, somewhat like that occurring in an ordinary battery. The new theory suggests that something more fundamental takes place in the iron, although an electrochemical reaction may also be present.

In a series of experiments during which the conditions required for electrochemical reactions were eliminated, the Westinghouse scientists reduced the rusting of iron to the simplest possible process. Pure iron wires about as thick as a fine sewing thread were reacted with oxygen and then with water vapor at 835 degrees Fahrenheit under controlled conditions.

## MEDICINE

# Hypertension Research

HIGH BLOOD PRESSURE (hypertension) caused by poor kidney blood supply can be corrected by surgery linking the main aorta and the kidney with synthetic vessels.

Dr. John R. Derrick of the medical branch of the University of Texas made this report at a meeting of the International Congress of Medicine and Surgery at the University of Puebla, 50 miles from Mexico City.

A minority of persons have a kidney that depends upon two or three small arteries rather than one big artery for its major blood supply, Dr. Derrick pointed out. He explained that research at the medical branch revealed that a blood-starved kidney of this kind gets local help when it calls for more blood, but usually this is at the cost of increasing blood pressure throughout the entire body. It also is a contributing cause of heart damage.

Dr. Derrick reported on a three-year study based on autopsy examinations of 520 hospital patients, many of whom had high blood pressure. The investigators found that 69% of the adults with small, dual kidney arteries had suffered from hypertension. Only 17.7%, a six-to-one ratio, of those with one large normal artery per kidney had this trouble.

Results of the corrosion were then studied under an electron microscope capable of magnifying objects up to 300,000 times.

The scientists reported that with dry oxygen the iron forms a protective coating from which grow billions of tiny round oxide whiskers less than one-millionth of an inch in diameter and 30-millionths of an inch high. Each whisker grows from a single, specific growth site.

With water vapor, however, there is a "startling change" in the oxide surface, the scientists reported. From the growth sites erupt thin, pointed bits of iron oxide that spread across the metal surface. Shaped somewhat like blades of grass, they are about one-millionth of an inch thick, 30-millionths of an inch wide and 300-millionths of an inch high.

As they grow, they spread more than 50 times in area over the sites observed for dry oxygen alone, reaching a density of nearly one billion per square inch of surface area.

The amount of iron rust they represent is 250 times that which forms when the water vapor, and the hydrogen ions it releases, are absent from the reaction.

The experiments by the Westinghouse scientists show that less than one part of water vapor in 200 parts of the dry oxygen atmosphere will cause the blade-shaped crystals to form. At room temperature this would correspond to a relative humidity of about three percent.

• Science News Letter, 78:79 July 30, 1960

Surgeons at the medical branch and elsewhere have been successful in a high percentage of cases in reducing blood pressure permanently by linking the main aorta and the kidney with synthetic vessels.

When a kidney needs more blood, the organ produces a chemical substance called renin. This is combined in the system with a substance in the liver known as angiotensinogen. This combination produces angiotensin, which then flows throughout the entire blood system of the body, causing a constriction of blood vessels resulting in elevation of the patient's blood pressure.

Dr. Derrick said further study in flow dynamics (motion and force) of blood is needed to bear out the initial findings of the medical research team.

To determine what kind of arteries supply a patient's kidney with blood, doctors are using new techniques for injecting dyes into the blood system of the suspect area, after which they obtain accurate X-ray photos.

The American Heart Association supported the research work of the Texas investigators.

• Science News Letter, 78:79 July 30, 1960