

## SCIENCE NEWS

*Science Service, Washington, D. C.*

## SOLUTIONS UNDER PRESSURE

THE newest studies of science which have fundamental application in such widely separated fields as the internal composition of the earth, the formation of the igneous rocks in the earth's crust, surface chemistry and important biological problems were described in a lecture given in Washington by Dr. R. E. Gibson, of the Geophysical Laboratory of the Carnegie Institution of Washington.

The emphasis of the research has been on the problem of how chemical mixtures synthesize under high pressure. The effect on the molecular structure of water produced by factors affecting the compressibility and expansion of solutions—as one example—is throwing light on phenomena connected with the solubilities of proteins in saline solutions and touches closely on the vital processes of living organisms.

In the same way a study of chemical building up at high pressure is important to a study of how the rocks in the earth's crust formed from the molten, mixed mass in the dawn of the globe's history. Only by simplification can scientists even begin to attempt the solution of this last problem which coordinates with the three decade study of Carnegie Institution on the nature of the earth in its varied aspects.

Experimental apparatus has been built in the Geophysical Laboratory, which duplicates in some small way the pressures or temperatures encountered in the earth. Temperature can be raised to 4,000 degrees Centigrade or the pressure can be increased to 240,000 pounds to the square inch. Either the high temperature or the high pressure can be obtained; but not simultaneously. With this equipment simple solutions are now being studied, such as methyl alcohol and glycol at room temperature and pressures of 1,000 atmospheres, or 150,000 pounds to the square inch. In studying the effects of high pressures on these simple water solutions, it has been found that the results throw light on the forces between the molecules of the dissolved substance and the fluid which acts as the solvent. It has been learned, for example, that when water is subjected to high pressures its structure is crushed. Some of the intermolecular bonds are broken and the liquid flows more easily than before. The structure of water that can be broken by high pressure consists of the grouping of water molecules into clusters of five, with a central water molecule being surrounded by four others in tetrahedral arrangement.

The much more difficult geological problem that the simple experiments are attempting to solve consists of a liquid mixture of a dozen or so elements, which most chemists have avoided, a mixture which can produce innumerable chemical compounds, all at white heat much above the temperatures usually employed in laboratories and under extreme pressures. An attempt will be made to determine what compounds will crystallize out, and in what order, as the mixture cools.

## A NEW MORPHINE

MORPHINE said to be more powerful and safer than the morphine that physicians now use to relieve suffering has

been prepared and patented by Dr. Lyndon F. Small, of the University of Virginia. The new kind of morphine—actually Dr. Small has patented three new morphine compounds—was discovered while he was trying to develop a non-habit-forming substitute for morphine. The goal of non-habit-forming morphine is being sought in a fundamental scientific attack on narcotic drug addiction initiated in 1929 by the National Research Council, the U. S. Public Health Service and the Treasury Department's Narcotic Bureau. The research on narcotic substitutes is being carried on at the Universities of Virginia and Michigan.

The new morphines have not yet been tried on human patients. Tests on animals show that they are less poisonous than ordinary morphine; that they are more powerful so that smaller doses can be given; that they act for a longer time, so that they need not be given as often as morphine in the relief of pain. As only animal tests have been made, no statement on the habit-forming possibilities of the new morphines can be made. Another morphine substitute, dihydrosesoxymorphine-D, which Dr. Small prepared two years ago, turned out to be more habit-forming than ordinary morphine, although preliminary tests encouraged the hope that it would be the long-sought non-habit-forming morphine substitute. Clinical tests on human subjects of the new morphines will be made shortly.

The invention comprises three new ethers of morphine and dihydromorphine, in which the alcoholic hydroxyl group of the parent substances (morphine and dihydromorphine) has been etherified: (1) Morphine alcoholic ethyl ether (heterocodethylin or heteroethylmorphine); (2) dihydromorphine alcoholic ethyl ether (dihydroheterocodethylin, heteroethyldihydromorphine); (3) dihydromorphine alcoholic methyl ether (dihydroheterocodeine).

## RESEARCH IN CHILD DEVELOPMENT

WHETHER a child's mental development can in the future be watched by means of a study of his brain waves was debated in Washington on October 30 in a special session of the conference of the Society for Research in Child Development. This technique for leading off electric impulses direct from the brain has put a new tool in the hands of those who are studying human minds. These waves come in a certain pattern which is characteristic of each individual. That this pattern may be determined even before birth was indicated by Dr. Hallowell Davis, of Harvard University Medical School. His experiments show a strong suggestion of hereditary or family characteristics. Identical twins show a very close similarity in their brain rhythms.

Dr. Donald B. Lindsley, of Western Reserve University and the Brush Foundation, reported that the significant brain waves do not appear in babies until they are 3 to 6 months old, and then increase gradually from a slow rate of three or four per second until the adult rate of 8 or 10 per second is reached when the child is about ten years old. This finding of a change in rate with develop-

ment suggests that the brain waves may serve as an index to growth and may in future be used to detect those children who are not developing at their proper speed.

Experiments with guinea-pigs reported by Dr. Leonard Carmichael, of the University of Rochester, were at variance with this finding. Characteristic rhythms are found in the guinea-pig at least twelve days before birth. In the youngest of the unborn animals, the rhythm occurred only in isolated periods with long periods of quiet. But, although the impulses came in a wide range of frequencies from 5 to 40 per second, predominating frequencies from 8 to 12 occurred at all the ages studied.

Dr. George Kreezer, of the Vineland, N. J., Training School, reported peculiar variations of brain waves in mental defectives of the Mongolian type who have mental ages below about 5 years. Because of the extreme sensitivity of the measuring devices used special care must be taken in studying brain waves in order not to be confused by other types of electric impulses.

Dr. T. Wingate Todd, of Western Reserve University and the Brush Foundation, reported that characteristic disturbances of the human digestive apparatus during Lent are not due to the religious fast period itself, but to atmospheric conditions at the approach of the Spring Equinox. Such disturbances are aggravated with stuffy noses near the Autumn Equinox. The effects of emotion as well as weather on the viscera have been studied by means of x-ray examination of the stomach as it digested certain test meals. Both stomach and colon are affected by emotion, but the stomach is more susceptible to momentary emotional upsets while the colon is affected more by long-continued strain. Special sensitivities, such as those which produce hay fever, hives, asthma, eczema and digestive disturbances, have a profound effect on the viscera, particularly the bladder. Most cases of bed-wetting are due in part to such sensitivities. The allergies are linked with both visceral reactivity and the workings of the blood vessels.

Dr. Chester W. Darrow, of the Institute for Juvenile Research, Chicago, recommended use of the so-called lie-detector for the study of children, not as a means of catching the children in lies, but to study their interests, emotional orientation and the situations which cause them mental conflict. Dr. Darrow suggested this technique for studying the electric resistance of the skin and the blood pressure, combined with association tests and special questions.

### ITEMS

THOUGH astronomers have no expectation of an unusually fine display, a number of meteors will probably be seen during the night of Sunday, November 15. This is the date of the Leonid shower, when the earth encounters a swarm of these bodies, bits of cosmic dust of pinhead size or smaller. After midnight they may be seen at the rate of about one every minute, instead of one every five minutes which might be seen on other nights. Because the meteors are all moving in parallel paths, the paths of light, which they show when they are burned by friction with the earth's atmosphere, seem

to converge in the distance. Since this is towards the constellation of Leo, they are called the Leonid meteors.

DR. MARK ZIEGLER, U. S. Public Health Service regional consultant to southeastern states, has been sent to Georgia to help fight infantile paralysis. The outbreak of the disease is not considered alarming in size, but because numerous cases have continued to occur in Mitchell County, Dr. T. F. Abercrombie, state health officer of Georgia and of the federal health service, requested aid in checking the disease.

THE epicenter of Tokyo's sharp earthquake on Tuesday, November 3, has been checked by American seismologists of the U. S. Coast and Geodetic Survey, on the basis of data collected by wire through Science Service. The point of greatest disturbance was calculated as in latitude 37.5 degrees north, longitude 142 degrees east. The time of origin was 3:45.9 P. M., eastern standard time, or 5:46 A. M., Tokyo time.

THE annual sales of surplus big game animals, including bison and elk, is being conducted by the Biological Survey, U. S. Department of Agriculture. These sales, which have become a more or less regular institution, are required to lighten the load on the various big-game ranges in the West, which can support only herds of definitely determined sizes. If any unsold animals are left after a suitable time, they will be given free to public or private institutions for propagation or exhibition.

A NEW "farthest south" has been reached by the European corn borer during the 1936 season, when the destructive larvae appeared in fields of mainland Virginia, which has hitherto been exempt from their invasion. Although the borer did not extend the western boundary of its territory beyond last year's lines in Michigan and Indiana, its numbers along this boundary increased markedly. This insect thrives best and carries on its invasion most successfully during wet weather. That it has been able to hold its own territorially and increase in numbers during a season of extreme drought is indication that it is ready to push westward rapidly next year if the season is more nearly normal.

ADVOCATES of filtration of public water supplies as against chlorination are called to account by the *Journal of the American Medical Association* in an editorial article. "If safe drinking water is desired, it may be obtained by chlorination. If it is clear water that is wanted, filtration may be employed at somewhat greater expense, but filtration can not guarantee continued safety of the water supply." The editorial makes plain that a community that must depend for its health protection on filtration alone or chlorination alone had better choose chlorination. Any method of water treatment calls for unceasing expert supervision. Failure to prevent the contamination of initially pure ground or surface water supplies and especially the failure to recognize the danger of cross connections between the pipes of the public water supplies and the pipes supplying water for industrial purposes or for fire protection have caused hundreds of outbreaks of water-borne disease.