G. Rowntree of Philadelphia that the hormone of the mysterious thymus gland visits precocity on future generations.

The development of improved television apparatus, iconoscope and kinescope, by Dr. V. K. Zworykin of Camden, N. J.

The application of the experience of automotive and aeronautical engineering to railroading, resulting in the development of high speed trains of a new mechanical breed.

The adding of 75 miles per hour (60 per cent.) to the speed of transport airplanes without requiring additional power, which came largely as the result of application of National Advisory Committee for Aeronautics research on engine location, cowling and wing sections.

The aluminizing of astronomical mirrors, replacing silvering, with the result that shorter wavelengths of light from the heavens can be caught and studied.

Science News Letter, November 24, 1934

CHEMISTRY

Hydrogen's Heavy Twin Has Already Had Romantic Life

By WATSON DAVIS

Extracts from Chapter 7 on Heavy Hydrogen in "The Advance of Science" (Doubleday, Doran)

IF IT WERE discovered that some substantial citizen of the world was actually twins and one of these twins was twice the weight of the other although they had passed for each other to all who knew them, there would be created in everyday life a situation such as confronted the chemists and physicists when in 1931 the twin nature of hydrogen was discovered. For hydrogen is one of the most substantial of chemical elements, more important perhaps than any other except carbon.

The discovery of a heavy kind of hydrogen, about twice the weight of ordinary hydrogen, has stirred scientists to a high pitch of intellectual excitement. It is more important than any of the recent isolations or discoveries of new chemical elements. It is even now ranked "among the great discoveries of science." It is the starting point in developing a far-reaching new field in chemistry.

Discovering Deuterium

Deuterium, as the heavy hydrogen has been christened, has started a fever in the chemical laboratories of the world. It has reoriented research programs, sidetracked less promising researches, and caused a rush to print that has filled the announcement columns of the chemical and physical journals. Whereas water was just water a few months ago, there is now heavy water, distinctly different from ordinary water. And there are actually nine chemical kinds of water. Biologists have joined in the race, to discover the effect of deuterium in heavy water upon living things.

"Urey, Brickwedde, and Murphy" is the way in which the scientific literature cites the research team that discovered heavy hydrogen. They are three young scientists, who were 38, 28, and 26 years old in 1931 when they acted as obstetricians to hydrogen's fission.

Predicted by Theory

Prof. Urey himself had speculated on the existence of double-weight hydrogen (and also triple-weight hydrogen and quintuple helium) after he had compared the proton and electrons in the kernels of the elements lighter than oxygen and had come to the conclusion that there was a place for more than one kind of hydrogen in the scheme of elemental things. By one of the coincidences that happen in science as elsewhere, Prof. Herrick L. Johnston of Ohio State University came to the same conclusion, and his predictive paper was printed by the side of Urey's in the same number of the *Journal of the American Chemical Society.* (*August,* 1931)

Acting upon Birge and Menzel's suggestion that there might be in ordinary hydrogen gas one part of hydrogen isotope 2 to 4,500 parts of mass one hydrogen atoms, Urey, Brickwedde and Murphy decided that the best way of concentrating the heavy isotope would be to take a quantity of ordinary hydrogen gas, liquefy it, and then evaporate all but a few drops of it. The heavy hydrogen would remain mostly in the last few drops. These drops were sealed into glass bulbs by Brickwedde in Washington and sent to Urey and Murphy in New York.

The spectrograph, that useful analyzer of the rainbow of light emitted by the intense activity of the atoms, was called into service. The little ampule of hydrogen gas, in which the experimenters confidently hoped they would find heavy hydrogen, was subjected to electrical discharge. In the way the light was emitted Urey and Murphy found telltale spectral "flags" which proved the existence of heavy hydrogen.

The Race for Heavy Water

With the existence of deuterium conclusively demonstrated, there was the great urge to get it isolated in such purity as to see whether it was markedly different from ordinary hydrogen. Dr. E. W. Washburn, chief of the U. S. Bureau of Standards, division of chemistry, who died early in 1934 in the midst of intensive research on deuterium, suggested and put into practice the method of separating deuterium by electrolysis. In the industrial plants that make oxygen and hydrogen gases by breaking up water with an electric current, Dr. Washburn found the first step in electrolytic separation already accomplished. The water in commercial electrolytic cells that have been operated for long periods was markedly richer in the heavier deuterium than ordinary tap water. The lighter kind of hydrogen had a tendency to go off as gas first when the water was broken up into its hydrogen and oxygen by the electricity. Further electrolysis of the water rich in deuterium gave what was, up to that time, the world's heaviest water.

Costlier Than Gold

Just what these figures, that differ markedly from the standard values accepted for water, mean, will be realized when it is remembered that water is the substance widely used in setting the standard values for freezing point, boiling point, and other physical constants.

Like any rare substance, the cost of heavy water was at first high. About the middle of 1933, 95 per cent. heavy water was valued at $150 a gram, $150,000 a quart. Early in 1934, Princeton University scientists produced it at an estimated cost of $5 a gram. With methods already developed, it can probably be produced in quantity at from $1 to $2 per gram, a figure that is higher than the 1934 price of gold. Compared with its early production costs of one-time chemical rarities, like neon, argon, helium, and even aluminum, the cost of heavy water is not excessive.

Now a Third Hydrogen?

While heavy hydrogen was being explored thoroughly, the search for "heavy, heavy hydrogen," or a mass three isotope, proceeded. There is growing evidence that triple hydrogen does exist, although there is probably not more than one part in ten billion parts of normal hydrogen. Lord Rutherford found evidence of the formation of triple hydrogen in bombardments involving double hydrogen. The extreme scarcity of triple weight hydrogen will probably prevent its isolation or its chemical utilization.

If the existence of mass three hydrogen is conclusively proved, the number of chemical compounds in the universe is prodigiously increased. Take water, for instance. With three kinds of hydrogen and three kinds of oxygen, there can be eighteen kinds of water. When the thousands of compounds containing hydrogen are considered, the complexity becomes bewildering.

Naming the Baby

Just as parents have the privilege of naming their children, discoverers have the right of christening new chemical babies. It was rather awkward to continue referring to "hydrogen isotope of mass two" when the infant was so lusty and needed so much writing about in scientific journals. "Heavy hydrogen," for precise scientific literature, was unsatisfactory because of the mass three hydrogen isotope. So Drs. Urey, Brickwedde, and Murphy held a scientific christening and dubbed the new heavyweight hydrogen "deuterium." To the more common mass one isotope they gave the special name of "protium," so that the old term of hydrogen might be applied to both and specifically reserved for the mixtures of the protium and deuterium which before deuterium's discovery were the only hydrogen known. Because the nucleus of the deuterium atom was useful as a particle in atomic studies, it needed a special name. "Deuton," corresponding to "proton," the long accepted name for the ordinary hydrogen atomic nucleus, was selected by Dr. Gilbert N. Lewis of the University of California who first obtained almost complete separation of the isotopes.

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ASTRONOMY

Mysterious "Great Red Spot" Of Jupiter is Explained

Island of Solid Ammonia Floating on An Ocean of Liquid Hydrocarbons Suggested as Its Structure

A GREAT island or berg of solid frozen ammonia floating on a sea of liquid hydrocarbons like ethane, ethylene and acetylene, is suggested as the structure of the long-known, mysterious "great red spot" observed on the surface of the planet Jupiter. The hydrocarbon ocean may be as large as the planet itself, which is 34,800 miles in diameter.

This astounding postulate is presented by Dr. Arthur Adel of the University of Michigan and Dr. V. M. Slipher of Lowell Observatory (*Physical Review, Nov.* 15) in describing research which provides indications of the nature of the atmosphere on the major planets: Jupiter, Saturn, Neptune and Uranus.

The largest constituents of the "air" of these distant planets of the solar system is methane, each molecule of which is composed of an atom of carbon and four atoms of hydrogen. Ammonia has previously been detected on Jupiter and Saturn.

The ammonia island suggested by Drs. Adel and Slipher could be created by the extremely low temperatures of the distant planets because they are so far removed from the source of the earth's and their own heat—the sun. Of the major plants, Jupiter is nearest to the sun, but is still 483,300,000 miles away, over five times as far removed as the earth. Neptune, most distant of all major planets, is 2,791,600,000 miles away from the sun.

Freezing Hydrocarbons

The presence of methane in the atmosphere of the large planets indicates the temperature is not lower than 265 degrees Fahrenheit below zero, which is the boiling point of methane. Yet this is low enough to freeze and liquefy such gases as ethane, ethylene and acetylene.

A search for other gases, report Drs. Adel and Slipher, "leads to the conclusion that the other hydrocarbons, if they are present at all in the atmospheres of the giant planets, must exist only in traces relative to the amount of methane present. Presumably, these hydrocarbons as well as many others exist below the atmospheres of the giant planets. The unanchored motion of Jupiter's Great Red Spot suggests that it is an island of solid hydrocarbon or ammonia floating in a vast hydrocarbon ocean as extensive as the planet's surface itself."

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BACTERIOLOGY

New-Found Yeast Strain Grows Below Freezing Point

YEAST that will grow at temperatures below freezing point has been discovered growing in cider, by James A. Berry of the frozen pack laboratory of the U. S. Department of Agriculture. (*Science, Oct.* 12). Mr. Berry isolated cells of the new strain of yeast, and grew cultures from them in beer wort at 28 degrees Fahrenheit, 4 degrees below the freezing point of water. Despite its chilly environment, the yeast grew freely.

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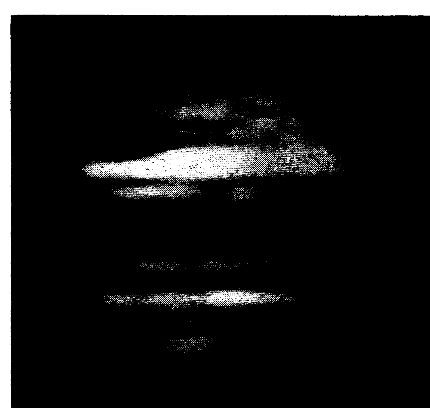
Calabash pipes are really made from calabashes brought from South Africa.



FRIGID FLOATING ISLAND?
Jupiter's great "red spot," showing like a big eye at upper left, may be an enormous mass of solid ammonia.