

SCIENCE NEWS

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THE MAKING OF A TELESCOPE MIRROR

"SLEET STORMS" at 3,000 degrees Fahrenheit, in which a layer of clear transparent quartz is coated on a base of white quartz by an oxy-hydrogen blowpipe, in much the same way that a clear layer of ice is sometimes coated on trees in a rainstorm in cold weather, may make possible the new 200-inch telescope, planned for the California Institute of Technology.

Speaking before the American Philosophical Society at Philadelphia on December 6, Dr. Elihu Thomson, director of the General Electric Company's research laboratory at Lynn, Mass., told of his researches on methods of making the huge mirror. This mirror, 200 inches, or sixteen and two thirds feet, in diameter, will be the heart of the telescope. It will be twice the diameter of the largest telescope mirror ever made before.

Unlike the ordinary small telescope, the new instrument will be a reflector, in which a disk-shaped mirror concentrates the rays of light from a distant star into a point on the photographic plate or in the eyepiece through which the astronomer looks. The final curve of the mirror must be ground very carefully, so that it will have exactly the right shape and give a sharp image.

Glass is the most popular material for telescope mirrors at present, but it has some disadvantages, according to Dr. Thomson. Changes in temperature produce a considerable change in the size of the glass. When any grinding is done, the friction heats the mirror. Then it must be allowed to cool before it can be tested, all of which consumes much time. And then, when the figure has been completed, and the telescope is in use, slight changes of temperature produce considerable changes in the image seen in the instrument. Therefore, it is not glass that we shall use, but fused silica, or quartz, melted in an electric furnace at between 1,700 degrees and 1,800 degrees Centigrade, which means more than 3,000 degrees Fahrenheit, or about the melting point of platinum, a metal difficult to melt, as is well known, and which does not melt in ordinary flames or furnaces. The method we shall use, and which we are using, in fact, on a small scale with great success, is, in general terms, one devised quite a number of years ago, and which consists in first melting a mass of good clean quartz sand in a circular mould in an electric furnace, and obtaining thereby a disc or thick slab of melted quartz sand. This is, indeed, fused quartz, but full of tiny bubbles, which tend to make it lighter, but the melted sand has all the desirable properties of the solid fused quartz itself.

Quartz has the advantage that it retains practically constant size for all ordinary temperatures. This makes a quartz mirror easier to figure and to use after completion. But the rough quartz disc, full of bubbles, will not take the smooth silver coating that reflects the light rays to a focus.

"This comparatively rough, bubble-filled mass of melted sand, which is the underlying disc, has to be pro-

vided with a surface layer, more or less thick, of clear glass-like fused quartz, or silica glass. It will have the same general properties, so far as expansion goes, and, therefore, will suit the purpose very well united to the sand backing. The first efforts were made by melting on to the fused sand backing slabs of clear quartz made in a different way, and the results were fairly successful. Fair mirrors could be made in that way, but at the suggestion of one of our skilled workers, an experiment was made of feeding into an oxy-hydrogen blowpipe flame, granulated or finely powdered crystal quartz (rock crystal) of high quality, and immediately it was found that a coating of clear quartz could thus be deposited upon any other piece of quartz. When oxygen and hydrogen are burned together in a jet, the temperature of the flame is high enough to fuse or melt silica, or quartz. By raining down through such a flame, the granulated crystal quartz is received on a surface much as ice deposits in clear layers on objects during a sleet storm."

SUN-SPOTS AND RADIO

GREAT activity on the sun, visible from the earth as a 700,000-mile row of sun-spots, has brought poor radio reception in recent weeks, but it will probably be followed by a gradual return to the good conditions of 1923, according to Dr. Harlan T. Stetson, director of the Perkins Observatory at Ohio Wesleyan University at Delaware, Ohio, in a statement made to *Science Service*. He believes the recent solar disturbance probably represents the peak of the present eleven-year sun-spot cycle. In collaboration with Dr. Greenleaf W. Pickard, radio engineer of Newton Center, Massachusetts, Dr. Stetson has been studying the relation between sun-spots and radio.

"The year 1930 should see a general decrease in solar activity, with a corresponding decrease in the ionization of the earth's atmosphere," Dr. Stetson declared. "This will favor the return of radio reception to normal conditions. During the subsidence period spasmodic outbreaks in the sun are to be expected at intervals, but with lessening intensity over the next five or six years.

"Scientists differ in their ideas as to just what happens when a broadcasted wave travels over the earth. Some believe that an ether wave is propagated which is reflected back to earth from an ionized layer of the earth's atmosphere known as the Kennelly-Heaviside layer which lies some 70 kilometers above the earth's surface. Others maintain that the electric wave is refracted rather than reflected from such a layer.

"Whatever the mechanism, the wave appears to be turned back by this ionized layer of the earth's atmosphere. Any change in the intensity or degree of this ionization or electrification of the earth's upper atmosphere would have the effect of bending the ray more abruptly or less abruptly towards the earth and would at once be noticed in the intensity of radio reception. The more rapid changes of this sort are doubtless responsible

for the phenomena of fading with which every radio fan is thoroughly familiar.

"According to our theory, the sun constantly bombards the earth's atmosphere with electrons or bundles of energy of high frequency which, in turn, tear apart the positive and negative charges of the atmospheric molecules. In other words, they ionize the atmosphere to a very considerable extent, thus producing the Kennelly-Heaviside layer. If the sun is more active on occasions, as when large spots appear on its surface, the degree of ionization increases, producing substantially the effect of lowering the Kennelly-Heaviside layer and upsetting the radio reception. When the sun is again less active, the atmosphere tends to return to its normal state of ionization and radio broadcasting reception tends to improve as the ionized layer lifts.

"For certain wave-lengths it is possible that the effect of a rising and falling ionized layer might actually be the reverse of that noted in the broadcasting zone, giving improved reception during greater solar activity and poorer reception during less solar activity. Curiously enough, this is just what has been observed by Dr. Pickard at the Newton Center Laboratory when working on long waves of 18 kilocycle frequency."

HEART-BEAT STARTED BY RADIOACTIVE POTASSIUM

THE potassium in the diet is the radioactive element which normally performs the vital function of starting the heart-beat, it appears from experiments conducted in the laboratory of Dr. H. B. Zwaardemaker, professor emeritus of physiology at the University of Utrecht. These experiments have been reported by Dr. Charles C. Lieb, professor of pharmacology at the College of Physicians and Surgeons, Columbia University, who has himself spent some time on research in Dr. Zwaardemaker's laboratory.

Earlier experiments of Dr. Zwaardemaker seem to have definitely established the fact that potassium is a radioactive element. The recent experiments have indicated that a radioactive element is essential in the initiation of the heart-beat, and therefore an indispensable element of diet.

Pursuing these studies further Dr. Lieb will investigate the pharmaceutical value of radioactive spring-waters, such as those found at Saratoga Springs, Arkansas Hot Springs, the Georgia Springs owned by Governor Roosevelt, of New York, where infantile paralysis cases are treated, and many other famous spas throughout the country. For years it has been known that the waters of these springs were radioactive, but the active charges have been so small that leading radium authorities have considered their radioactivity a negligible quantity therapeutically.

Dr. Zwaardemaker's work, Dr. Lieb pointed out, not only indicates that the radioactivity of potassium is one millionth to one-hundred millionth that of radium, but that even this minute charge is essential to the maintenance of the heart-beat.

"This may mean," said Dr. Lieb, "that even the very slight degree of radioactivity in the waters of famous spas is of distinct therapeutic value, although it is impossible for me to make any statement on the subject before extensive experimentation. Dr. Zwaardemaker discovered, however, that the radioactive elements uranium, polonium, thorium and radium may replace potassium in some of the simpler processes of cell activity.

"In just what radioactive group potassium must be placed we have not determined. Probably that is the work of a physicist. But it does seem to be established that potassium gives off beta radiation. This is distinguished from alpha and gamma radiation as being in the order of the electron. Alpha radiation consists of helium atom nuclei, while gamma radiation is hard like X-rays.

"It is apparently the electrons from potassium atoms and their ionizing power that furnish the energy necessary in initiating the heart-beat, but we are not yet prepared to discuss the mechanics of the process."

Dr. Lieb explained that the experiments consisted of the perfusion of the hearts of eels and frogs. When the hearts of these animals are taken out canulae, or small glass tubes, are attached to the blood vessels and fluid is passed through the hearts. The fluid does not contain potassium or other radioactive elements at first, and the heart ceases to beat in half an hour to an hour.

Potassium is then introduced into the liquid and the heart resumes its beat and continues to beat for about twenty-four hours. Similar results are obtained when instead of potassium another radioactive element is used. Not only did this physiological action lead to the conclusion that potassium was radioactive, but measurements on specially constructed electrometers indicated that it gave off beta radiation.

SEX HORMONES

THE important sex hormone has just been obtained in pure form for the first time by a German scientist, Dr. M. Butenandt, working at the laboratory of a recent Nobel Prize winner, Professor Adolf Windaus, at the University of Göttingen.

This hormone, which has been known to the medical profession for some years, is thought to be capable of restoring the functioning of the reproductive organs. Heretofore it has been obtained only in combination with other compounds, but Dr. Butenandt has been able to produce the hormone itself in pure form, as a crystalline substance which he has named progynon.

The sexual hormone is one of a number of curious and as yet little understood substances which are secreted by the ductless glands of the human body. Each of these special chemicals is responsible for the proper functioning of certain bodily activities, and physiological chemists believe that a systematic study of these secretions will lead not only to an understanding of the physical operations of the body, but even to an explanation of mental characteristics and that elusive property called "character."

The importance of obtaining a hormone in a pure state is that it is the first step toward the determination of its

structure and its synthetic production in the laboratory. The action of the hormones within the body and their influence on other chemical processes of the body may be better understood after the structure of the hormones has been determined.

Progynon belongs chemically to the group of stearates, or fats, and it is related to the artificial vitamin, vigantol, discovered by Professor Windaus. This also puts it in the same class as the poison of toads and the bile acids. On the other hand, adrenalin, the hormone of the suprarenal glands, is related chemically to the plant drugs known as the alkaloids, of which morphine is a well-known example. Adrenalin was the first hormone isolated in a pure state, and it has since been produced synthetically.

ELECTROSURGERY IN TREATING CANCER

THAT new and novel adjunct to the surgeon's knife, electrosurgery, finds its greatest usefulness in the treatment of cancer, Dr. Howard A. Kelly, emeritus professor of gynecology and obstetrics in the Johns Hopkins University, told members of the Southern Surgical Association at their meeting in Atlanta on December 10.

This new method is not to be mistaken for merely a more convenient form of cautery, but is a specialty which must be learned with painstaking care, Dr. Kelly emphasized. He urged that the new procedure be given more attention in the big hospitals of the country, and that the younger generation of surgeons be given opportunities to test it out.

One very important advantage of electrosurgery is that it controls hemorrhage easily without the need of tying off each vein and artery, which must be done at each step of other surgical operations.

"In deep operations by older methods the surgeon often loses precious minutes in his efforts to check a severe hemorrhage and feels as well estopped from going further in that direction. With electrosurgery the lymphatics and smaller blood vessels are sealed with the progress of the operation.

"It sterilizes the parts attacked, destroying all bacteria and septic tissues as well as the malignant cells to which the growth owes its specific character and continuance. There is further no handling and squeezing of the tissues, a great boon in any aggressive treatment of malignancy, avoiding the further distribution of the cells.

"One might also well call it a knife and fork operation as the handling of the parts is limited to the slight sterilizing touch of the simple instruments used, avoiding even the gloved fingers of the surgeon.

"An immense advantage lies in the greatly enhanced facility in operating in areas awkward or difficult of access as in the nose and throat."

Dr. Kelly described the method in some detail and added that it is even valuable, in some types of cases, when radium can not be used any longer.

ITEMS

A METHOD of removing a diseased organ by chemical rather than surgical means was described by Dr. Charles

H. Mayo, of Rochester, Minn., at the Atlanta meeting of the Southern Surgical Association. The technical term for the operation is "chemical hysterectomy." The procedure is particularly valuable in cases when the usual surgical methods of hysterectomy would be too dangerous to undertake because of the presence of serious disease in the heart or kidneys as well as in the organ to be removed. In the method followed by Dr. Mayo zinc chloride is the chemical used. He has used the procedure in 26 cases in which it was unsafe to operate by one of the usual procedures. He believes that, in its limited field, the method is of value.

LEAVES millions of years old which still hold all the colors of autumn have recently been found in the newly discovered fossil leaf beds of Wheeler County, central Oregon, by Dr. Ralph W. Chaney, paleobotanist of the Carnegie Institution of Washington. The perfect preservation of the coloring in the leaf impressions is attributed to minerals in the matrix. Dr. Chaney found in volcanic shale an intact leaf, bearing virtually the appearance it did when it fell from a jungle tree millions of years ago. This leaf was sealed in its matrix and will be sent to the University of California at Berkeley. The plant horizon is just above the beds of the Cretaceous seas which swept over ancient Oregon, leaving an abundance of marine fossils in the Mitchell area.

ALONG the Susquehanna River have been found village sites once occupied by the Conestoga Indians. Eighty-nine complete pottery vessels and many other every-day possessions of this extinct tribe have been unearthed by G. B. Fenstermacher, of Lancaster, in cooperation with the State Museum at Harrisburg. Captain John Smith, who first encountered the Conestoga in 1608, described them as being warlike and far superior in physique to other neighboring tribes. Yet they were conquered by the Iroquois Indians in 1675, and less than a hundred years later the twenty warriors that were the only remnants of the once powerful tribe were massacred by white men, at Lancaster, Pa. Growing interest in Pennsylvania's prehistory has lately aroused the state legislature to appropriate \$20,000 to the Historical Commission for the purpose of conducting researches within the state.

AFRICAN crocodiles can harbor a form of sleeping sickness from the tsetse fly, but this is not the human type. The crocodile gets the disease by sleeping with his mouth open, thus permitting the flies to walk around and bite the soft membranes exposed. The disease is not transferred in the bite, but may be transferred if the beast wakes up irritated and snaps at the flies, thus crushing them and swallowing the parasites or germs carrying the disease. This particular germ requires the crocodile and the fly to complete its life cycle just as a malarial parasite requires man and the mosquito. These facts were determined by Cecil A. Hoare, of the Wellcome Bureau of Scientific Research, in a study on crocodiles made at the Human Trypanosomiasis Research Institute at Entebbe, Uganda.