

SCIENCE NEWS

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A FILM PHONOGRAPH

BORN of the talkies, a film phonograph capable of playing continuously for two hours from a 400-foot reel of motion picture sound film has been perfected by Dr. C. H. Hewlett, engineer of the General Electric Company. From a reel of film small enough to fit into a coat pocket a complete play or opera can be reproduced, which otherwise would require 15 to 20 ordinary 12-inch disc records.

Talking motion picture technique allowed Dr. Hewlett to achieve his result. In one of the principal methods of recording sound for the talkies, a jagged line photographed on the edge of the film is the representation of the sound. Light passes through a narrow slit, through the film on to a photoelectric cell. As the teeth of the jagged line pass by the slit, they vary the amount of light reaching the cell, which in turn varies the intensity of an electric current. When this current is amplified and fed into a loud speaker, a reproduction of the original sound emerges.

Dr. Hewlett's film phonograph record has no sequence of photographs and contains only sound records. It lacks the perforations of ordinary motion picture film. At present there is space for nine separate sound tracks side by side, but he hopes soon to increase its capacity to fifteen. When the film has run through once it is necessary to shift to the next sound track. In early models this was done by recording the second track backwards, and reversing and shifting when the end was reached. The third track ran forward again, and the operation was repeated until the film ended.

Now, however, a continuous loop of film is used, unwinding from the inside as it winds up on the outside, after the fashion of automatic movie machines used for window displays. When a track ends, the machine shifts automatically to the next in a fraction of a second, with practically no interruption of sound. With this system and nine tracks, a program lasting an hour and twenty minutes can be played without attention. With fifteen tracks the machine will play for over two hours.

Recording is done through the same kind of microphone as used in radio or ordinary record studios. The light from a 50-watt incandescent lamp passes over a straight edge close to the lamp, and is focussed on a small mirror made to vibrate electrically in step with the sound waves. The edge is reflected upon a small slit, so that, as the mirror oscillates, the light shining through varies. A microscope lens focusses this slit on the film one tenth its actual size, and as the film moves along, the jagged line is photographed.

MICRO-ANALYSIS

A NEW discovery, of value to scientific research and to industry—the chemical analysis of particles so small that hitherto they defied all attempts to determine their composition—was explained recently by Dr. W. C. MacTavish, professor of chemistry at New York University. The

analyses were made by two young Austrian chemists now connected with New York University—Dr. Anton Benedetti-Pichler and Dr. Joseph Niederl, both of them former students of Professor Fritz Pregl, who received the Nobel Prize for his work in micro-analysis. Both come from the Chemical Institute of the Technical High School at Graz, Austria.

Dr. Niederl demonstrated a method of analysis discovered by one of his pupils at New York University, William Saschek. He termed it the "microvaporimetric molecular weight method of analysis," by which he determined the composition of a fraction of a drop of liquid. Then Dr. Niederl explained that there are as yet only three other laboratories equipped to do micro-analysis—that of the Rockefeller Institute, where he helped to install the apparatus, and the laboratories of Columbia and the Johns Hopkins Universities.

Illustrating the value of the method, Dr. Niederl explained that he recently had determined for one of the leading New York laboratories the chemical constituents of a small drop of substance produced in an effort to find a rubber substitute and that upon another occasion Dr. Pichler had determined microscopic impurities in iron that was being galvanized. The method may be used in determining the genuineness of old paintings and coins, he said.

In demonstrating the micro-vaporimetric molecular weight method, Dr. Niederl analyzed about a third of a drop of liquid contained in a capillary tube. The tube was placed in mercury and then broken, releasing the liquid. The mercury was then heated until the liquid from the tube became gas. As the gas expanded it forced off an amount of mercury equal to its volume. By taking into consideration the temperature at which the gas was vaporized, together with its volume, its molecular weight was determined. Dr. Niederl said a method of analyzing mixed substances was now being developed.

Dr. MacTavish also demonstrated an automatic chemist that uses an electric eye to keep the analysis under control. The device is fairly simple. A beam of light is cast through the liquid being analyzed so that it falls upon a photoelectric cell. Above the beaker containing the liquid under investigation is a tube which passes an acid drop by drop into the beaker. A small amount of chemical indicator added to the liquid in the beaker makes the liquid red, so that the beam of light passing through it is not powerful enough to operate the relays connected with the photoelectric cell.

When a sufficient amount of acid has dropped into the beaker the red color disappears, indicating complete neutralization. This allows enough light to pass through the liquid to operate the relays and give the chemist a signal that his test has been completed.

"Using a robot of this kind around a chemical laboratory will save a great deal of the chemist's time," Dr. MacTavish said. "Its electric eye is ten times as sensi-

tive as the human eye and will distinguish shades of color impossible to the chemist."

A colleague of Dr. MacTavish, Dr. H. M. Partridge, has perfected a method of producing lithium in such quantity as to make it commercially available at low cost. Although it formerly cost \$20 an ounce, it now is produced for \$20 a pound, he said. He has prepared one piece about the size and shape of a baker's jelly roll, which is probably one of the largest pieces ever made. The metal weighs one fifteenth as much as iron and is fifteen times as bulky. It is so light it floats in kerosene, having only one half the specific gravity of water.

"One of the unique properties of lithium," Dr. MacTavish explained, "is that it will unite with nitrogen at ordinary temperatures and makes possible the direct synthesis of ammonia. In the present methods of making artificial fertilizers from nitrogen in the air the chemical reaction takes place in an electric arc having a temperature of several thousand degrees."

THE BRAIN OF THE HAGFISH

DETAILED examination of the structure of primitive brains has shown an unexpected complexity in the arrangement of their connecting fibers, but at the same time has demonstrated the fundamental unity of the animal nervous system. The work was done by Dr. J. L. Conel and Dr. Jan Jansen, of the University of Chicago, and is summarized in *Physiological Zoology* by Professor C. Judson Herrick.

The unit of nervous action usually shown in the textbooks is the "reflex arc." This involves a sense organ, a sensory nerve leading to the brain or other nerve center, and another nerve, the motor nerve, leading out again to muscle, gland or other tissue that registers the response. On the basis of this, it might have been expected that the simplest brain would show a simple and orderly grouping of a relatively limited number of such arcs.

But when the two anatomists actually analyzed a number of primitive brain types they found a quite different picture. They worked on hagfish, which are the lowest of vertebrates; and these are compared by Professor Herrick with the tadpoles of frogs and toads, together with related animals, the salamanders, "mud-puppies" and "Hell-benders." The hagfish brain proved to be no simple switch-board for a few separate reflex arcs, but bewilderingly complex, though of course the complexity was of a different pattern from that of a higher animal. Nerve fibers ran from sensory centers into all sorts of unexpected places, branching and branching again, until anything like the simple reflex arc of the diagrams was out of the question.

It was all very confusing, until it was looked at from the developmental and functional side. The life of a hagfish is very simple and uneventful. Only two of its senses—smell and touch—are at all highly developed, and its only response to any kind of stimulus is a wriggle involving its whole body. Each stimulus that comes in, therefore, must be transmitted as an order to move to muscles all over the body. Hence the apparent random

branching of the nerves, and their distribution in a seemingly "haywire" pattern, for fibers from this whole pattern converge into the muscles, always with the same response—a wriggle.

The nerves are not a set of separate signal wires, strung from one part to another to satisfy new and unheard-of needs. They arise more as though an originally single telephone line could branch into a party line as the family it served grew up and moved into several houses, continuing to serve them and flexibly adapting itself to the increasing number and complexity of their needs.

The separate reflex arcs as we see them in a human body stand, not at the beginning, but at the end of this process of development. From the beginning of animal evolution the body behaves as a whole. At no stage of development is behavior carried on by a number of separate or detached reflex arcs.

PARROT FEVER

THE only cases of parrot fever or psittacosis have been reported among pets in homes or shops. The only human cases have occurred as a result of intimate contact with infected birds. Many people who keep parrots and other birds make a custom of feeding their pets from their own mouths. The histories of cases of psittacosis in human beings all show that the sick parrot had been handled and fondled by the persons who subsequently became ill. In a case reported in England, the bird's mistress, in order to keep her sick pet warm, allowed it to sleep under a woolen jacket against her breast.

However, no danger of infection seems to exist unless there is this direct contact. Consequently, Dr. William M. Mann, director of the National Zoological Park at Washington, D. C., said it has not been considered necessary to close the parrot room to visitors, even though several cases of psittacosis have been reported in nearby Annapolis. Dr. Mann added that the disease had never occurred among the parrots of this zoo, where it would surely have been detected as post-mortem examinations are made of all the birds that die there.

Dr. Mann was not able to give any reason why parrots in zoos should be free from this disease when parrots destined to become pets occasionally have it. The disease is caused by a germ which attacks the birds infrequently, it appears. So far, it has not attacked any birds in the zoo. Scientists are not agreed as to the exact germ causing the disease. There seems to be considerable evidence that it is the *Bacillus psittacosis*. Some authorities think the unsanitary conditions under which birds are kept on the journey up from the tropics may have some relation to the development of the disease.

So far it has not been a serious enough menace to warrant placing quarantine restrictions upon parrots. There is a considerable profit in the sale of these birds. Exact figures on parrot imports are not available, but according to the Department of Commerce, 65,319 live birds other than song and game birds, and valued at \$5 apiece and under, were imported from South America in a year. The value of these imports was \$127,156. Be-

sides parrots, this included cockatoos, love birds and parakeets. Of birds valued at over \$5 apiece, there were 1,592 imported, at a total value of \$26,870.

When human beings contract psittacosis, they have the symptoms of pneumonia and also of typhoid fever. They suffer from extreme weakness, high fever, a cough, nausea and intestinal disturbances. The disease is fatal in 35 to 40 per cent. of the cases. Some authorities think that the patients actually have pneumonia, that the parrot has simply weakened their resistance and made them more susceptible to pneumonia. The disease in the parrots is confined to the digestive system, but in man it is localized in the lungs.

An English authority, Dr. A. P. Thompson, of Birmingham, thinks the disease is perhaps not so very rare, but that a number of cases of it may occur which are considered to be some form of pneumonia or typhoid fever, particularly if the fact of a sick parrot in the household is not known to the physician. This was almost true of one case which Dr. Thompson attended. He was kept from a mistaken diagnosis in this case by the insistence of the patient's niece that her aunt had what the parrot had had.

The first case of psittacosis was reported from Germany in 1879. An epidemic of the disease occurred in Paris in 1892, at which time parrots had been very fashionable pets. Since then cases have occurred at intervals particularly in Italy, France and Germany, with only a few in England and the United States. During the last year, reports of cases have been more frequent in Europe and South America. An outbreak is now reported from Germany.

PREHISTORIC INDIAN HOUSE IN MISSISSIPPI

THE complete plan of a big circular Indian house has been excavated in a cotton field in Mississippi, is the announcement made by Henry B. Collins, Jr., of the U. S. National Museum. Mr. Collins, who has just returned from Mississippi bringing a drawing of the house plans, said this is the first discovery showing clearly how the prehistoric Indians of the Southeast designed their buildings.

The house, which is in the frequently plowed cotton field of Claude Pepper near Deasonville, was recently recognized as an Indian site when bones and potsherds were dug up by two young men working for the Mississippi Department of Archives and History. These men, Moreau Chambers and James Ford, invited Mr. Collins to work with them in excavating the site.

The house plan shows three circles of post holes which were used for roof supports. The outermost circle is sixty feet in diameter. Tracing the circles with a string, as the Indians probably did in the first place, the archeologists found that the circles were perfectly laid out. The Indian house builders dug the three circles in shallow trenches and set the posts firmly two feet deep within the trenches. The wall of the structure was very likely of wattle-work of reeds plastered with clay. Traces of a fire pit were inside the house, and also a square of

post holes which provided additional roof supports and possibly set off an inner room.

The outermost trench was filled in with kitchen and household refuse, including bones of deer, bear, and smaller animals, fish jaws, clam and mussel shells, arrow points, bone scrapers and awls, one pipe and much broken pottery. Some of the pottery is a red and white kind heretofore found only in Arkansas. The trash of an Indian settlement was usually piled in a heap, and it is difficult to account for this use of it to fill the trench. One headless skeleton was unearthed in this trench. The tribe of Indians who built the house is not yet known. It is possible that this was one of the Mound Building tribes, for several mounds rise above the fields within half a mile of the round house.

ITEMS

AN engineering memorial to George Washington, the engineer, which would include the restoration of canal locks at Great Falls on the Potomac, is being sought by the American Engineering Council. It is proposed to complete the reconstruction by 1932 when the George Washington bi-centennial will be held. Washington's canal at Great Falls, a few miles west of Washington, is remarkable when the crude machinery he had to work with is considered. The canal on the Virginia side of the river is cut through rock for a distance of 40 feet at the lower end. As first laid out it consisted of five locks which took care of a 76-foot fall.

A NEW German invention, making it possible to bring a seaplane from the ocean surface to the deck of an ordinary passenger liner with a minimum of danger and inconvenience is described by Martin Grell in a report to *Die Umschau*. It consists of a runway of sailcloth which can be unrolled from the stern of the ship and trailed in the water, allowing the plane to climb upon its lower end, whence it is pulled to the deck by a winch. The canvas is kept taut and its lower edge held beneath the water by a suitable drag. With the ship steaming at a reduced speed of from five to seven knots, the runway is rigid enough to support an ordinary plane and five men.

THE United States has 350 cities in 36 of its states where there is at least one habit clinic to which problem children may go to have their troubles understood and adjusted, the U. S. Children's Bureau has found as a result of a check-up on the increase in these child guidance institutions. The bureau has recently issued a pamphlet directory listing the 500 psychiatric clinics for children in this country, thus showing the available resources in any given locality. It is only twenty years ago that the first clinic for the study of delinquent children was set up in connection with the Chicago juvenile court, Miss Grace Abbott, chief of the bureau, stated in comment. The number to-day is still insufficient to meet more than a small fraction of the needs of delinquent children and the needs of the children who are serious failures at school or who suffer from timidity and other personal handicaps.