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PAPERS PRESENTED AT THE DETROIT MEETING OF THE FEDERATION OF AMERICAN SOCIETIES OF EXPERIMENTAL BIOLOGY

A NERVE fiber can not carry a second nerve impulse within an interval of about a thousandth of a second following a previous impulse, Drs. Hallowell Davis and A. J. Derbyshire, of the Harvard Medical School, reported at the meeting in Detroit of the American Physiological Society. This "refractory period" explains the mechanism of auditory masking, they said. They investigated the electrical activity of the ear and of the hearing or auditory nerve of the cat when the ear is stimulated by two sounds simultaneously such as musical tones and sharp clicks. Just as the click would interfere with hearing of the fainter musical tones, the electrical disturbances which signal the passage of nerve impulses in the ear of the cat show masking of one sound by the other. If the click falls immediately after the sound wave of the musical tone it will be masked. If it falls just a trifle earlier, the click will set up nerve impulses and be heard and one wave of the musical tone will be lost. If the two sounds compete in this way for the same nerve fibers, one or the other will be masked to a certain extent, depending on which one succeeds in first exciting the nerve fiber. In the sense organ of the inner ear, there is no evidence of any such masking. Both sets of sound waves are represented simultaneously in the activity of the sensory cells, just as they are carried through the air as complex sound waves.

EVIDENCE that the stimulus to the nerve of hearing is chemical and not electrical was presented by Drs. A. J. Derbyshire and H. Davis, of the Harvard Medical School. They examined the electrical phenomena which are produced in the ear by the sound of a click. This stimulus produces two well-known responses, they found. One is developed by the sensory cells in the ear when they are subjected to the mechanical pressure of a sound wave. The other is the electrical change associated with the nerve impulses in the auditory or hearing nerve. They found that this impulse in the auditory nerve travels at the rate of about 60 miles an hour. Even after accounting for the time for the impulse to travel along the auditory nerve, however, they found a delay of 5 ten-thousandths of a second between the response of the sensory cell and the start of the impulse along the nerve. This delay could not be explained by the theory of stimulation by the electrical response of the sensory cell.

EVIDENCE that rage is not concerned with the adrenal glands alone but may occur with all its outward signs quite independently of adrenal gland action was presented by Dr. N. B. Taylor, C. B. Weld and J. F. Sykes, of the University of Toronto. According to one theory, when a situation arises to provoke anger, the adrenal glands pour out into the body large quantities of adrenalin which in turn leads to tensed muscle, glaring facial expression and other signs of rage in man and lower animals. It was found that the same signs of rage could be provoked by stimulating the brain by a drug called ergotoxin while the nerve supply to the adrenal glands was cut. In this case, the signs of rage were due to the abolishing of certain inhibitions of brain and central nervous system.

A DIET containing large amounts of starches and sugars may become an important part of the treatment of liver disease, particularly when the patients must undergo surgical operations. Experiments suggesting this were reported by Drs. J. L. Bollman and F. C. Mann, of the Mayo Clinic. A fatty liver, they found, can not properly do its important job of protecting the body from poisons, but the fat in the liver can be rapidly decreased by adding generous amounts of starches and sugar to the diet. The composition of the liver can be varied within wide limits by diet. Eating excessive amounts of fat increases the fat in the liver from a normal value of about four per cent. to twenty or thirty per cent. within three weeks. In extreme cases almost half the liver may be fat. At the same time there is a decrease in the amount of water and glycogen, which is the form in which the liver stores sugar.

EXPERIMENTS showing that the brain gets its energy for thinking from glucose or sugar were reported by Drs. H. E. Himwich and J. F. Fazikas, of Yale University. The brain takes sugar from the blood, breaks it up into simpler chemical combinations, and burns the lactic acid thus obtained to get energy just as a steam engine gets its energy from burning coal. Dr. Himwich and his associate found accidentally that when nicotine is mixed with brain tissue in a flask, the brain can not burn lactic acid but the burning (oxidation to the chemists) goes on just the same if glucose is present. So it appears that the brain has two ways of getting energy for thinking from glucose or sugar. Ordinarily it gets the energy *via* lactic acid, but if this is impossible, it gets the energy directly by burning the glucose. The amount of nicotine that gets to the brain when a cigarette is smoked, however, is probably too small to affect the burning of lactic acid. Incidentally, nicotine is not responsible for the increased sugar in the blood caused by tobacco smoking, according to Dr. Ephraim B. Boldyref, of Battle Creek Sanitarium.

ENCOURAGING results from treatment of diabetes by x-raying the pituitary and adrenal glands were reported by Drs. B. O. Barnes, W. L. Culpepper and J. H. Hutton, of Chicago. The results were obtained with dogs that had diabetes as a result of removal of the pancreas. One of the physicians had previously found that x-ray treatment of pituitary and adrenal glands improved the condition of human patients suffering with diabetes. Dr. Barnes reported last year that diabetes experimentally produced may be markedly improved by removing either

the pituitary gland, at the base of the brain, or part of the adrenal glands that lie atop the kidneys. Naturally, this drastic procedure can not be used in the treatment of diabetes in human patients. In these experiments, diabetes was produced by removal of the pancreas and the animals were given enough insulin to correct the diabetes. After a control period, x-ray treatments were given and it was found that with these treatments the animals needed much less insulin. The x-ray treatments apparently had an effect similar to removal of the pituitary and adrenal glands.

RICKETS-PREVENTING vitamin D is of great benefit in the treatment of arthritis or rheumatism, as it is sometimes called, according to Dr. C. I. Reed, of the University of Illinois College of Medicine. Seventy out of one hundred arthritis patients treated by himself and associates, Drs. M. L. Hathaway and H. C. Struck, were definitely helped and some apparently cured. The vitamin was given in the form of concentrated viosterol and enormous doses were used. While three thousand units is the standard dose for the treatment of rickets, Dr. Reed used one million units and in some cases three million to treat the arthritis patients. All kinds of arthritis except that due to gonorrhea were helped.

MATERNAL instinct is affected by hormones. It can be aroused in virgin rats by daily injections of prolactin, according to a report made by Drs. Oscar Riddle, Ernest L. Lahr and Robert W. Bates, of the Carnegie Institution of Washington. Prolactin, the hormone that arouses the fundamental maternal instinct, is produced by the powerful and important pituitary gland at the base of the brain. Besides arousing the maternal instinct, prolactin stimulates the production of milk in animals that nurse their young and of crop milk in pigeons. Prolactin has another remarkable action. When injected into adults, it reduces the size of the male sex glands. The largest dose reduced these glands to about 8 per cent. of their original size. A female sex hormone from the pituitary gland, on the other hand, increased the size of the male sex glands up to 65 per cent. above that of the normal adult size of these glands.

THE dryness of extreme thirst is apparently only relative, no matter how it feels, for even during extreme thirst a measurable amount of saliva is secreted. Experiments showing this to be the case were reported by Dr. Erma A. Smith, of the Iowa State College. According to previous theory, the feeling of thirst is due to dryness of mouth and throat resulting from lack of saliva. Dr. Smith's experiments seem to show that this is not the case. Dr. Smith first measured the saliva secretion during a control period in a series of normal adults. Then she gave them several ounces of a saturated solution of common salt, and continued to measure the saliva during the following thirsty period. In some persons the flow of saliva was diminished; in others it was increased; in none did it cease. From this she concluded that a measurable flow of saliva and extreme thirst occur simultaneously.

THE discovery of a hitherto unknown protein material in food absolutely essential to growth and life was announced by Dr. William C. Rose, of the University of Illinois, to the American Society of Biological Chemists. It is No. 22 in the list of the known amino acids in the proteins of the body and No. 8 in the list of those that have been shown to be necessary to life. Scientifically its name is: Alpha-amino-beta-hydroxybutyric. The newly found amino acid was discovered, identified and prepared synthetically by Dr. Rose and his associates, Dr. H. E. Carter, Richard H. McCoy and Miss Madelyn Womack of the physiological chemistry staff. About five years ago, in attempting to learn which were necessary to life, Dr. Rose and his associates fed animals a mixture of foods containing no protein but to which had been added all of the 21 amino acids then known. The animals receiving such a mixture declined rapidly in weight and eventually died. This was interpreted as indicating the presence in proteins of a hitherto unknown component which was essential to life. With that in mind a search began for the substance in question. The search was rewarded with the recent isolation of this new acid. When it and the 21 previously known acids are added to an otherwise normal diet, but one which lacks proteins, normal growth and weight are produced. This is the first time on record that animals have grown on mixtures of highly purified acids in place of proteins.

A DRUG that will sober-up intoxicated dogs was reported by Professor R. N. Harger and H. R. Hulpieu, of the University of Indiana School of Medicine, at the meeting of the American Society for Experimental Pharmacology and Experimental Therapeutics. The drug is a yellow powder known to chemists as dinitrophenol. It has recently been used to cause fat people to lose weight. Because it is very dangerous when used without a physician's supervision, the Indiana scientists particularly warn the public not to use it as a home remedy after a spree. "Severe poisonings and several deaths have resulted from its rather wide-spread use by overweight people." The experiments showed that the drug enabled the dogs to burn the alcohol they had been given much more rapidly than the usual rate. While the drug produced some fever in the dogs, which caused them to breathe more rapidly, very little of the loss of alcohol was by way of the lungs. Other investigators have shown that the body can burn alcohol only at a fixed rate and that exercise, exposure to cold and similar conditions will not speed up the burning of alcohol by the body. This discovery is the first example of any procedure which will speed up the burning of alcohol by the body.

A NEW theory of the cause of cataracts in old people and in diabetics was presented by Dr. Helen S. Mitchell, of the Massachusetts State College and Battle Creek College, Michigan, to the American Institute of Nutrition. Dr. Mitchell found that she could produce cataract in rats within two weeks by feeding them a little more than a third of their ration as galactose. This is a sugar not found as such in nature but formed in the body from

milk sugar. As a result of her studies, Dr. Mitchell believes that some cataracts, particularly those occurring in diabetes, are due to faulty handling of sugar by the body. The cataracts produced in her rats were the same kind as occur in diabetes and in old people. Dr. Mitchell emphasized that her work is only beginning and much more study is needed to solve the mystery of why cataracts form.

WOMEN are more susceptible to coffee than men. Experiments confirming this generally accepted view and showing women to be twice as susceptible as men were reported by Drs. Kathryn Horst and J. Robert Willson, of the University of Michigan Medical School, at the meeting of the American Society for Pharmacology and Experimental Therapeutics. Seven young men and seven women took part in the experiment. They drank coffee on one day of each week for several weeks and on the intervening days drank decaffeinated coffee. The amount of tremor in the index finger was carefully measured to determine the effect of the coffee. The rate or frequency of the tremor normally present was the same, no matter which beverage was taken. The amplitude or what might be considered degree of tremor, however, was increased for several hours after a single dose of coffee, but was not changed by the decaffeinated coffee. In women a strong cup of coffee containing from one and one half to two grains of caffeine produced this increase in the amplitude of the tremor, but it took more than twice this amount to produce the same effect in most of the men.

A PERSON poisoned by nicotine stops breathing because the nerve endings in the muscles of his breathing apparatus are paralyzed. The drug does not paralyze the breathing center in the brain, as has been generally believed. These discoveries, which suggest a new method of treating nicotine poisoning, were reported by Drs. Harry Gold and Frederick Brown, of Cornell University Medical College. Artificial respiration, rather than drugs to stimulate the breathing center in the brain, is the method suggested by the Cornell investigators for treating cases of nicotine poisoning in which breathing has been dangerously slowed or stopped altogether. Stimulating drugs can only make matters worse in such cases because the partially paralyzed nerve endings require rest, such as can be obtained by artificial respiration. A substance like barbital, which has a depressing rather than stimulating effect on the nerves, can abolish the convulsant action of nicotine. An animal treated with this substance can survive an otherwise fatal dose of nicotine.

DRS. F. A. GIBBS, H. Davis and E. L. Garceau, of the Harvard Medical School, reported to the American Physiological Society that an electrical hook-up to the brain producing wavy lines traced on paper gives a new clue to what goes wrong in epilepsy. They find by this means that epilepsy is probably a neurological storm which results in great piling up of electrical discharges. The tracings of the small waves of electricity which come off from the brain are called "electroencephalograms" and are like the now familiar electrocardiagrams which give physicians information about the action of the heart. Normally these waves come off the brain at the rate of about ten per second. When a person is sleeping, in a faint, or loses consciousness temporarily in the strange sleep disease called narcolepsy, the brain waves are slowed down to about three to five per second and have about double the normal voltage. In minor epilepsy, just before and during an attack, the brain waves come off about every three seconds and in a strange pattern of large round waves with a spiky wave between the round ones. In major epilepsy both fast and slow waves of much greater than normal voltage are found. The disturbance in brain activity as shown by these tracings of the electrical waves from the brain goes on even when the epileptic patient is not having a fit or seizure and is in one of his apparently normal periods.

PROOF of the effectiveness of small doses of acetanilid in reducing fever in animals was offered by Dr. Paul K. Smith and Dr. W. E. Hambourger, of the Yale University School of Medicine. Acetanilid has been used to relieve pain and reduce fever for almost fifty years, but the proportion of a fatal dose required for lowering temperature has never before been determined. One sixtieth of a fatal dose of acetanilid suffices in rats to lessen the fever. One thirtieth will reduce the fever to normal, and one fifteenth will even lower the temperature in normal animals. It was shown that healthy animals will survive relatively large dos

COD-LIVER oil, old-time standard [illegible] remedy, has not nearly so much rickets-preventing vitamin D or growth-promoting vitamin A as many other fish oils. Oils from mackerel, tuna, sea-bass and swordfish have from 100 to 400 times more of these vitamins than cod-liver oil, Dr. Charles E. Bills, of Mead Johnson and Company, reported at the meeting of the American Society of Biological Chemists. With his associates, Drs. Francis G. McDonald, O. N. Massengale, Miriam Imboden, Helen Halls, H. D. Hergert and J. C. Wallenmeyer, Dr. Bills examined the oils of 100 species of fish for their content of vitamins A and D. Three quarters of all the liver oils were more potent than cod-liver oil in vitamin D and nearly all surpassed it in vitamin A. The vitamin content of the oils varies with the zoological classification of the fish. Most potent in vitamins A and D are the fish of the order percomorphi, to which belong mackerel, tuna, sea-bass and swordfish. Next come rockfishes and sculpins. Fish with soft bones contain little vitamin D and no measurable amount of this vitamin could be found in sturgeon or gray sole.

DR. WALTER SEEGERS, of the State University of Iowa, reported that liver and other meat extracts lose some of their nourishing properties and are not as digestible when heat or alcohol is used in the extraction process. This is in line with the recent report from California that protein in bread becomes less digestible the longer it is cooked, and that the crust is the least digestible part of the loaf.