perform a task according to his own judgment. He might then have his work graded and criticized on the basis of whether he had done a good or a bad piece of work or whether his ideals of scientific procedure were right or wrong. It appears that a student who used the present manual would get a high grade if he did "what teacher said."

A. S. PEARSE

REPORTS

AWARDS OF THE ELLA SACHS PLOTZ FOUNDATION

DURING the twelfth year of the Ella Sachs Plotz Foundation for the Advancement of Scientific Investigation, seventy applications for grants were received by the trustees, thirty-four of which came from the United States, the other thirty-six from fifteen different countries in Europe, Asia and South and North America. The total number of grants made during this year was twenty-five, one of these being a continued annual grant. Twelve of the new grants were made to scientific men outside of the United States.

In the twelve years of its existence, the foundation has made two hundred and fifty-two grants, which have been distributed to investigators working in Argentina, Austria, Belgium, Canada, Chile, China, Czechoslovakia, Esthonia, France, Germany, Great Britain, Hungary, Italy, Jugoslavia, Latvia, Netherlands, Palestine, Poland, Portugal, Roumania, South Africa, Sweden, Switzerland, Syria, Venezuela and the United States.

The list of investigators and the purpose of their researches aided in the current year is as follows:

Professor E. Aubel, Paris, the synthetic reactions of the liver and their rôle in specific dynamic action.

Professor Dr. G. Barkan, Tartu-Dorpat, Esthonia, the biology of iron and iron metabolism.

Professor Marston Taylor Bogert, Columbia University, New York, New York, synthesis from *p*-xylene.

Dr. S. J. Crowe, the Johns Hopkins Hospital, physiology of the ear.

Dr. William Dameshek, Boston, blood pigment metabolism in lead poisoning.

Professor Dr. Philipp Ellinger, London, the kidney and vitamin B deficiency.

Professor Erdheim, Vienna, a special joint disease of dogs.

Professor E. Gelhorn, University of Illinois College of Medicine, Chicago, the influence of hormones and vitamins on phagocytosis.

Dr. W. Gohs, Vienna, the etiology of blood diseases and osteodystrophy fibrosa.

Dr. Arthur Grollman, the Johns Hopkins University, the adrenals; crystallization of the hormone.

Dr. F. Gudernatsch, New York University, growth.

Dr. I. F. Huddleson, Michigan State College, Brucella infection.

Dr. H. A. Krebs, Cambridge, England, the mechanism of ketogenesis and anti-ketogenesis.

Dr. Jean LaBarre, Brussels, extraction of incretine from duodenal extract.

Dr. Hans Lampl, Vienna, mechanical heat regulation in animals.

Professor O. Loewi, Graz, anterior lobe of pituitary and carbohydrate metabolism.

Dr. Charles C. Lund, Boston, the hormone intermedin.

Dr. Michel Magat, Paris, France, the hydration of ions.

Dr. John R. Murlin, University of Rochester, New York, the mechanism of secretion.

Dr. Yellapragada SubbaRow, Harvard Medical School, Boston, isolation of materials.

Thorndike Memorial Laboratory, Boston City Hospital, (Professor George R. Minot, director), continued since 1927 in recognition of Dr. Francis W. Peabody's services to the foundation.

Professor Dr. Ernst Wertheimer, Jerusalem, the relationship between free and bound glycogen in normal and pathological conditions.

Dr. Carl J. Wiggers, Western Reserve University, the dynamics of the coronary circulation.

Dr. William F. Windle, Northwestern University Medical School, the development of behavior in the embryo.

Professor Dr. Fritz Verzar, Basel, physiological research by Dr. Laszt.

The maximum size of the grants will usually be less than $500. Applications for grants to be held during the year 1936–1937 must be in the hands of the executive committee before May 1, 1936. They should be sent to Dr. Joseph C. Aub, Collis P. Huntington Memorial Hospital, 695 Huntington Avenue, Boston, Massachusetts, U. S. A.

SPECIAL ARTICLES

THE ABILITY OF RATS TO DISCRIMINATE BETWEEN DIETS OF VARYING DEGREES OF TOXICITY[1]

IT is a rather common belief that animals possess the ability to select foods most beneficial to them when a choice is offered. In an area where the forage possesses varying degrees of toxicity this ability would have tremendous significance. In certain districts in the great plains area, seleniferous vegetation probably occurs as an interspersion of vegetation of varying

[1] Published with the permission of the director of the South Dakota Agricultural Experiment Station as communication No. 21 from the Department of Experiment Station Chemistry, and is Part XIII of "A New Toxicant Occurring Naturally in Certain Samples of Plant Foodstuffs."

degrees of toxicity. Steyn[2] found that specimens of the same plant in the same stage of development and growing beside each other varied considerably in toxicity. Many of the residents of these districts are firm in the belief that range animals are able to recognize the seleniferous vegetation and eat only the least toxic or normal forage. If this belief is based on fact, then one solution to the problem would be the reversion of the land to a grazing area. The experiment reported below lends support to the idea that animals recognize seleniferous vegetation.

Franke[3] observed that rats on a toxic diet invariably restricted their food intake, and Franke and Potter[4] showed that this food restriction was mainly responsible for the poor growth of the experimental animals. Osborne and Mendel[5] and Mitchell and Mendel[6] reported experiments which indicated that rats possess the ability to select the proper constituents for normal growth, although Kon[7] reported an experiment in which rats which selected their own quantities of protein, carbohydrate and salt showed growth which was inferior to that of rats on a compounded diet. Forbes and Bechdel[8] reported that young deer did not like laurel and rhododendron, which are toxic, and if allowed grain would eat very little of these plants.

The experimental work reported herein was much easier to control than any of the experiments reported above, and demonstrates conclusively that rats possess the ability to recognize diets of varying selenium content.

Experimental

A preliminary experiment (Series 59) was carried out in which a group of five rats were given two diets, each compounded according to the same formula diet No. 3 (see reference note 4), but one made with normal wheat and the other made with toxic wheat No. 582, which contains 30 ppm of selenium by analysis. In four 30-day periods the intake of toxic diet, in terms of per cent. of the total, was 6.3 per cent., 3.2 per cent., 4.1 per cent., and 2.7 per cent., respectively. On the basis of this observation, a second experiment (Series 113) was set up in which several diets of varying toxicity were offered.

Ten rats of Wistar Institute origin were weaned at twenty-one days of age and placed on the control wheat diet (No. 3). When the age of the rats was thirty-seven days, they were divided into two equal groups and placed in two all-metal stock cages with raised screen bottoms. Group I was given a choice of four diets, which were mixtures of the control wheat diet and the toxic wheat diet, so that the rats were given a choice between (1) control diet, (2) 25 per cent. toxic diet plus 75 per cent. control diet, (3) 50 per cent. toxic diet plus 50 per cent. control diet, and (4) 100 per cent. toxic diet. Group II was given control wheat diets to which had been added various amounts of sodium selenite. A total of five diets were offered as follows: (1) control, (2) 7.5 ppm of selenium, (3) 15 ppm of selenium, (4) 30 ppm of selenium, and (5) 60 ppm of selenium. Inasmuch as wheat No. 582 contains 30 ppm of selenium, the diets for Group I contained 0, 6.15, 12.3 and 24.6 ppm of selenium, respectively, and contained no diet comparable to the 60 ppm selenium diet in group II.

The diets were placed in identical spill-proof feed cups, placed at random in the cages. The various diets were made up to a total of twenty-five grams each, on the supposition that the five rats would normally eat about fifty grams of feed and would accordingly eat all the least toxic diet and be forced to the

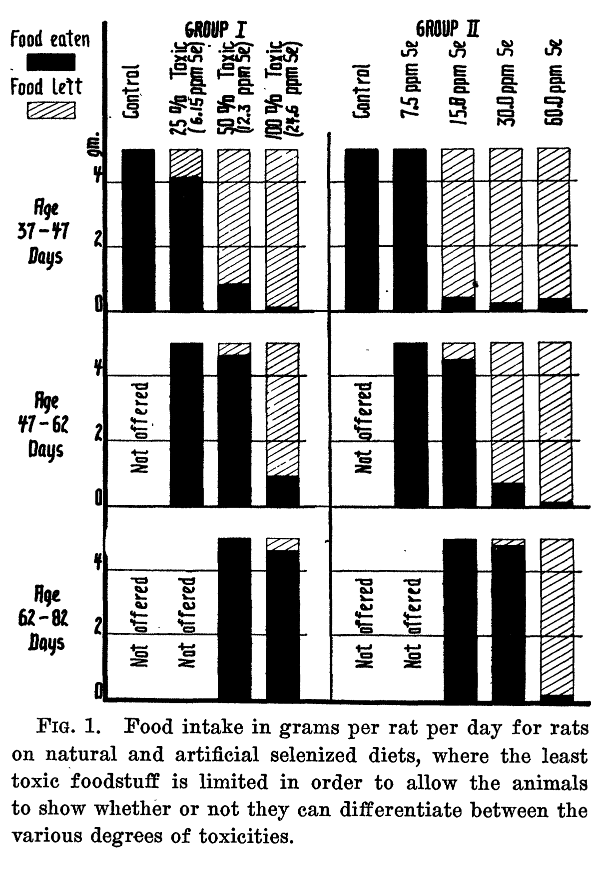

Fig. 1. Food intake in grams per rat per day for rats on natural and artificial selenized diets, where the least toxic foodstuff is limited in order to allow the animals to show whether or not they can differentiate between the various degrees of toxicities.

[2] D. G. Steyn, 18th Rept. Dir. Vet. Serv. and Animal Industry, Union of S. Africa, 899–938, 1932.

[3] Kurt W. Franke, *Jour. Nutrition*, 8: 597, 1934.

[4] Kurt W. Franke and Van R. Potter, *Jour. Nutrition*, 8: 615, 1934.

[5] T. B. Osborne and L. B. Mendel, *Jour. Biol. Chem.*, 35: 19–27, 1918.

[6] H. S. Mitchell and L. B. Mendel, *Am. Jour. Physiol.*, 58: 211, 1921.

[7] S. K. Kon, *Biochem. Jour.*, 25: 473–481, 1931.

[8] E. B. Forbes and S. I. Bechdel, *Ecology*, 12: 323–333, 1931.

next toxic diet to appease their hunger. Food intake was recorded daily. After ten days, the control diets were no longer offered in either group, and after fifteen days, the next least toxic diet was no longer offered. In every instance, the rats ate the least toxic food that was available and ate negligible quantities of the more toxic diets. The average food intake in grams per rat per day is indicated in Fig. 1. Since the diets were of identical compositon, the only variable in group I was the amount of toxic grain, and in group II, the only variable was the amount of sodium selenite. It is apparent that the rats were able to distinguish between diets which differed in selenium content by small increments. The animals were also able to distinguish between various concentrations of the natural toxicant, in spite of the fact that in this case the selenium is in organic combination (Painter and Franke[9]). Although constituents other than selenium may have furnished a clue to toxicity in the naturally toxic diets, there was certainly no other possibility in the diets used in group II.

No deaths occurred in the above experiment, although growth was subnormal. When killed, the animals showed typical pathologic effects for sublethal diets.

CONCLUSIONS

It has been quantitatively demonstrated that rats are able to detect and differentiate between small quantities of selenium in foodstuffs. Unpublished data in this laboratory have shown that sub-lethal injections of sodium selenite cause a voluntary starvation even when normal diets were offered. The question whether or not systemic effects may be the entire factor controlling this differentiation should not be ignored, although this selection of foods may be due to taste of the diets or even odor.

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SUBMERGED VALLEYS ON CONTINENTAL SLOPES AND CHANGES OF SEA LEVEL

BETWEEN 1893 and 1902 Spencer,[1] Hull,[2] Upham[3] and others advanced the hypothesis that certain topographic features discovered on the continental slopes of Europe, North America and Africa were submerged river valleys. Their ideas met with much hostile, though somewhat unfounded, criticism from their contemporaries[4] and, being thus discredited, were practically forgotten for thirty years. The work of Shepard in the last few years has reopened the whole problem and again brought it to attention. The development of sonic sounding has made possible detailed investigation of the topography of the sea bottom. The U. S. Coast and Geodetic Survey is at present producing charts with very accurately located bathymetric contours which leave no doubt as to the bottom configuration and presence of the valleys.

It now appears extremely likely that Spencer, Hull and Upham were correct in their conclusion that the valleys are submerged river valleys. The validity of this conclusion will not be discussed as it has already been treated more or less fully in the several papers by Shepard[5] and also by Hess.[6] Professor R. A. Daly has recently advanced the hypothesis that the valleys are the result of submarine scour by muddy salt water produced by the 250 ± foot lowering of sea level during the Pleistocene. Though this hypothesis is well worthy of consideration, the form of the valleys, the fact that they have been deeply cut in some cases through rocks as resistant as granite, and finally that any slight turbulence would cause a mixing of the muddy water with the surrounding water, all lead the writers to favor a subaerial origin. In this note the writers wish briefly to advance a hypothesis accounting for the valleys and point out some of the chief geologic consequences which this hypothesis, if correct, would entail. Explanatory hypotheses have been elsewhere advanced, but none of them fit the facts as now known.

DISTRIBUTION AND DEPTHS

At least forty of these submerged valleys have been noted, and no doubt many more will be found when more soundings are taken on the continental slopes. They are known to occur in many parts of the world; off the coast of North America from Newfoundland south; off the coast of Europe from Ireland south; off Ecuador and Peru on the west coast of South America; off the coast of North America from Vancouver Island south; on the west side of the Pacific off Japan, Formosa and the East Indies; on the east coast of Africa off the Congo, Niger, Cape Verde and Gibraltar Straits; in the Indian Ocean off Ceylon; off the Indus and the Ganges and in the Arabian Gulf; and south of Zanzibar on the east coast of Africa.

Many of the valleys are known to extend to depths

[9] E. Page Painter and Kurt W. Franke, *Jour. Biol. Chem.*, 111: 643, 1935.

[1] J. W. Spencer, *Bull. Geol. Soc. Amer.*, 14: 207–226, 1903.

[2] E. Hull, "The Sub-Oceanic Physiography of the North Atlantic Ocean," London, 1912. Also, *Royal Geog. Jour.*, 13: 285–289, 1899. Also, Victoria Inst., 1898–1908.

[3] W. Upham, *Am. Geol.*, 10: 222–223, 1892.

[4] *Royal Geog. Jour.*, 13: 289–294, 1899.

[5] F. P. Shepard, *Geog. Review*, 23: 77–89, 1933. *Trans. Am. Geophys. Union*, 1933 and 1935.

[6] H. H. Hess, *Trans. Am. Geophys. Union*, 168–170, 1933.