A REVERSED CAT

AN adult female cat purchased for student use in comparative anatomy was found, upon dissection, to have its internal organs completely reversed in every detail studied. Lungs, kidneys, veins and arteries and all parts of the digestive tract were normal in size and shape but so situated that descriptions for the left side fitted the right perfectly and *vice versa*. The aortic loop arose from the larger right ventricle and arched to the right. Other parts of the heart and its vessels were changed accordingly. The animal, although heavily infested with tapeworms and undernourished, appeared sound and normal in every other respect. No reference to an entirely reversed cat has been found in the literature. It may have been one of a pair of identical twins, since it is supposed that the occurrence of the phenomenon of reversal in man and other mammals is due to splitting of the embryo at some early stage.

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ELLIPTICAL ERYTHROCYTES

SINCE Gulliver[1] reported his measurements of the red blood corpuscles of many species (including the sloth) writers in text-books and special treatises have said as Jordan[2] said lately: ". . . among mammals the shape of the red blood corpuscles is uniformly that of a circular biconcave disk, except in the Camelidae, where these elements have an elliptical shape."

So far as I can learn no one questioned that statement until in a recent article Schartum-Hansen[3] included the sloth among mammals having elliptical erythrocytes. This note is written in the hope that some one who is in a position to do so will tell us who is right about the erythrocytes of the sloth.

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M(ANILLE) IDE, THE DISCOVERER OF "BIOS"

IN connection with attendance at the 16th International Physiological Congress this past summer in Zurich, I had an opportunity to visit the University of Louvain, in Belgium, where "bios" investigations originated about 1900. I hoped to be able to find out more about Wildiers (deceased in 1906), under whose name the first article on this subject was published, and who is credited by some as being the first discoverer of a vitamin. After careful questioning, both of Dr. Ide (ēd′ĕ), emeritus professor of pharmacology, and his successor, Professor André Simonart, I was fully convinced that I had found, still living, the discoverer of "bios" in the person of Professor M(anille) Ide.

E. Wildiers was an immature undergraduate medical student of comparatively mediocre attainments at the University of Louvain. He helped Dr. Ide with his research which culminated in the discovery of "bios," and was allowed by Dr. Ide to use the results of the research in a thesis which was submitted in a competition for a traveling fellowship. (Incidentally, he did not win the award.) Under these conditions Professor Ide's name could not appear on the publication. Wildiers continued his medical course, graduated and practiced medicine in Antwerp until the time of his death from scarlet fever in 1906. It is patent, especially in view of Dr. Ide's continued interest in this work from its inception to the present, that the credit for the discovery should go to him rather than to the immature and otherwise unproductive medical student who happened at the outset to help him with the experimental operations. Since 1901 Professor Ide has continued his investigations and has had the help of a number of medical students, among them two generations of R. Devloo (1906 and 1938).

Since his retirement (he is now 72) Professor Ide has continued his medical practice in the forenoons, but the afternoons find him working enthusiastically in his laboratory provided by the University of Louvain. He was without any laboratory assistance at the time of my visit, but was nevertheless actively carrying on the experimental work. He is enthusiastic in his work, a highly respected colleague in the University of Louvain and a most gracious and charming gentleman.

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ABSTRACTS OF PAPERS PRESENTED AT THE CHAPEL HILL MEETING OF THE NATIONAL ACADEMY OF SCIENCES. II

Later evidence concerning meteoritic origin of Carolina "bays": W. F. PROUTY (introduced by Edward W. Berry). The meteoric theory of Melton and Schriever as modified by Prouty and MacCarthy is supported by recent magnetometer surveys and other field observations. A grid survey of a large area near Syracuse, South Carolina, which contains a number of well-spaced bays shows that there is a spot magnetic high associated with each of

[1] George Gulliver, *Proc. Zool. Soc. London*, p. 474, 1875.
[2] H. E. Jordan, "Downey's Handbook of Hematology," Hoeber, p. 840, 1938.
[3] H. Schartum-Hansen, *Acta Medica Scandinavica*, Vol. 86: fasc. II, p. 348, 1935.

the medium sized to large bays and that there is an absence of well-defined spot highs in areas away from the influence of the bays. The distribution of bays is restricted geographically, but in areas in which they occur, there seems to be no relationship to topography or rock character. Bays are elliptical with definite orientation. Sinks are irregular in shape and orientation. In soluble rock areas some bays have been modified by solution; such "bay-sinks" are sand-rimmed and distinguishable from sinks. Various "bay-sinks" suffer solution-elongation in various directions. The size of bays is independent of topography and solubility of rock. Movement of sands in bay areas is in general northeast as shown in present shape of bays and relation of sand-rims and dune areas to the bays. Section of two small, overlapping bays by the Intercoastal Waterway, near Myrtle Beach, furnishes a comparative study of sub-surface conditions in peat-filled elliptical bay area and peat-filled irregular shaped swamp areas nearby. Only under elliptical bay area is the underlying impervious clay layer penetrated by swamp water in sufficient quantity to dissolve the two fossil shell beds below. In conclusion it can be said that the latest investigations concerning the origin of "Carolina Bays" still further support the modified meteoric theory of their origin. All present known facts concerning the bays as observed by the writer seem to fit into this theory.

Changes in shape accompanying tetraploidy in cucurbit fruits: E. W. SINNOTT and A. F. BLAKESLEE. The most commonly observed differences between members of a polyploid series in plants have been the size differences resulting from the increased cell size which follows an increase in number of chromosome sets. That such changes may be accompanied by qualitative ones is shown by the marked differences in fruit shape between diploid races of various cucurbits and tetraploid races produced from them by treatment with colchicine. In every case the tetraploid fruit is distinctly shorter and wider than its corresponding diploid type. This result has been brought about both by changes in the shape of the early fruit primordium and in the relative growth rates of length and width during development. Races of *Cucurbita Pepo* and of *Lagenaria vulgaris* show this change, which is similar to that previously reported for capsule shape in Datura. Why an increase in chromosome number and cell size, with no alteration in genetic constitution, should produce such a specific change in form presents an important morphogenetic problem.

Observations on cilia of aquatic Phycomycetes: J. N. COUCH (introduced by A. F. Blakeslee). By staining with Loeffler's stain it has been found that the cilium of certain chytrids as *Rozella septigena* Cornu, *Woronina polycistis* Cornu, *Rhizophidium* (several species), *Cladochytrium replicatum* and other undescribed forms is composed of the long, rather thick, basal part which one can see by the usual staining technic and in addition a thin distal part which is invisible on the living spore and even when stained by the usual cilia stains. *Monoblepharis regignens* and *Allomyces moniliformis* have the same type of cilium. It seems highly probable that it is the thin part of the cilium that propels the spore, the thick part acting as a rudder. This kind of cilium is usually correlated with the absence of cellulose in the walls, but in certain undescribed forms the cell walls are of cellulose. Such chytrids with cellulose walls have given rise to no higher types but represent an offshoot from the main chytrid line. A second type of cilium occurs in *Rhizidiomyces apophysatus* and an undescribed genus which we have in culture on agar. Here the uniciliate spore lacks the thin distal part of the cilium, but frequently shows short, thin, lateral appendages. This kind of cilium is correlated with the presence of cellulose in the walls. It is unlikely that any of the existing higher Phycomycetes are derived from this line, for the higher forms all possess biciliate zoospores. A third type of ciliation has been recognized in the Phycomycetes. In an undescribed genus (an endo-parasite in the threads of an *Achlya*) closely related to the potato parasite, *Spongospora,* the spores have two cilia, one long, the other short, the short cilium having a long thin appendage. In *Olpidiopsis* sp. on *Achlya* a similar appendage has been found on one of the cilia, both of which are of about the same length. In *Pythium aphanidermatum* both cilia possess short, thin appendages, and in *Saprolegnia* and *Achlya* the thin appendages may usually be seen on one or both cilia. These studies indicate at least three lines of evolution in the aquatic Phycomycetes: (1) the chytrid-*Monoblepharis* line; (2) the *Rhizidiomyces* line; and (3) the biciliate line terminating in such forms as *Saprolegnia* and *Pythium.*

Interspecific grafts and mixtures among the Dictyosteliaceae: KENNETH B. RAPER (introduced by Charles Thom).

The structural organization of cellulose in cotton fibers: DONALD B. ANDERSON (introduced by Edmund W. Sinnott). The wall of the cotton fiber is composed of very minute thread-like strands of cellulose which anastomose freely with each other, forming a close-meshed network. In the oldest layer of the cell wall the cellulose strands are oriented in flat spirals, but in subsequent deposits the strands wind in steep spirals which frequently reverse their direction. The structural organization of the cellulose units in the wall does not appear to be influenced by environmental factors, but the rate at which the cellulose is deposited is subject to environmental control. It is possible, therefore, to control the apparent stratification in the wall of the fiber or to eliminate it completely by regulating the temperature and light during the period of cell wall thickening.

Downy mildew of tobacco: FREDERICK A. WOLF (introduced by R. A. Harper). Downy mildew of tobacco seedlings first appeared in Florida in 1921 and was eradicated only to reappear in 1931. The disease now involves nearly all tobacco-growing areas in the eastern United States and southern Canada. It is caused by *Peronospora taba-*

cina, a fungus having a sporangial stage by which it is disseminated and an oosporic stage by which it survives from one year to the next. Sporangia are formed at daybreak and are air-borne. Oospores constitute the inoculum for primary infections. Seed beds that occupy the sites of old infected beds are foci of infection. The severity and course of downy mildew are governed by weather conditions, cold, rainy, cloudy periods being especially favorable. Infection may be completely prevented or the disease may be checked, once it has begun, by use of benzol vapors. The minimal concentrations of benzol vapor that are effective have been determined. The modificatory influence of moisture, temperature, porosity of covers, amount of benzol applied, wind velocity and surface area of evaporators, upon treatment of seedlings with benzol vapors, has also been evaluated.

A saprophytic alga: W. C. COKER and LELAND SHANOR (introduced by E. D. Merrill). At two stations in northern Chatham County, N. C., in small runs receiving seepage from a burning sawdust pile, we have found a remarkable plant having the appearance of a higher green alga but with the nutrition of a saprophytic fungus. It has a body closely resembling that of *Stigeoclonium*, but is entirely without chlorophyll or any trace of an organ resembling a chloroplast. The cytoplasm is confined to an extremely thin layer under the wall, and each cell has a large conspicuous nucleus. The tip cells of the branches are extremely tenuous and end in a fine point, which is found to be viscid. These tip cells fall off easily and attach themselves by their points to objects in the water. Reversing their polarity, they soon develop into a much-branched plant reaching a length of about 1 cm and having exactly the appearance of a vigorous water mold. This vegetative propagation by the distal cells is the only method of multiplication which the plant has, so far as known. A complicated group of rhizoidal holdfasts is sent off from the basal cell and from several cells above it. The cell walls are not of cellulose, which fact still further complicates the situation. Several parasitic alga-like plants that have quite or nearly lost their chlorophyll are known, but, so far as the writers are aware, no strictly saprophytic species with the form of an alga has ever before been found.

Concerning the acquired resistance of renal epithelium to bichloride of mercury: WM. DEB. MACNIDER. If the kidney of the dog be slightly injured by uranium nitrate the epithelium of the convoluted tubules at which point this metal has a selective action repairs itself by the formation of a normal type of epithelial cell for this location of the nephron. Such cells have no resistance to a secondary injury by uranium. If the epithelium in this segment of the tubule be severely injured by uranium nitrate the epithelial repair process results in the formation of a flattened or syncytial type of cell which is atypical for this segment of the tubule. Associated with the development of this atypical type of cell formation there is acquired on the part of such cells in this segment of the tubule a marked degree of resistance against uranium nitrate. When bichloride of mercury is administered to an animal it selects for its major point of action in the kidney the specialized epithelium found in the convoluted tubule. When animals have received a severe renal injury for uranium nitrate so that an atypical type of epithelial repair has developed in the convoluted segment of the tubule the use of bichloride of mercury fails to show any evidence of injury to such epithelium in this segment of the nephron. The observation would indicate that injury to epithelial tissue by one type of toxic agent may protect an epithelial tissue of repair from a toxic agent of another type, provided the processes of repair to the epithelial tissue from the injurious agent has led to the formation of a change in the morphology of the epithelial cells in the location at which the different types of injurious agents exert their nephrotoxic action.

The growth-promoting properties of certain cystine derivatives: JAMES C. ANDREWS[1] (introduced by Wm. deB. MacNider). Although biological sulfur is chiefly introduced into the body as cystine and methionine and eliminated in the form of sulfates in the urine, the intermediate steps in this process are largely unknown. Sulfur metabolism may be arbitrarily divided into two main processes, both of which must take place before sulfates are produced: rupture of the bond between sulfur and carbon and oxidation of the sulfur to the hexavalent condition. One object of sulfur metabolism studies is to determine the order of these two reactions, the latter of which undoubtedly takes place in a series of steps. In judging the status of any given sulfur compound as an intermediary metabolite two criteria are used: ability of the compound to produce urinary sulfates and ability to substitute for cystine and methionine in supporting growth. The latter is by far the more exacting criterion since many inorganic sulfur compounds readily oxidize to sulfates but do not support growth when added to a diet deficient in cystine and methionine. In the present work, several derivatives of cystine were synthesized and administered to rats in a basal diet deficient in cystine and methionine. Cyclic derivatives such as cystine hydantoin and cystine phenyl hydantoin, the sulfonic acid oxidation products of the above hydantoins, a substitution product (dibenzoyl cystine) and a product of partial oxidation of cystine (cystine disulfoxide) were all used. The following results were obtained: Oxidation of the sulfur to the sulfonic acid group entirely inactivates the compound for growth support. Formation of hydantoin rings, with or without oxidation of the sulfur, inactivates the compound. If, in addition, a phenyl group is present, its further toxicity produces still more sharply declining growth curves. Dibenzoyl cystine, being capable of partial hydrolysis in the digestive tract, acts as a partial substitute, while cystine disulfoxide, which is very unstable and readily loses oxygen to form cystine, serves as a satisfactory substitute. This, however, by no means proves that cystine disulfoxide is necessarily an intermediary metabolite of cystine.

[1] In collaboration with James H. Jones, University of Pennsylvania, and Kathleen C. Andrews.

Studies on the chemical composition and functional significance of mammalian lymph: RUSSELL L. HOLMAN (introduced by Wm. deB. MacNider). The following studies were made in an attempt to throw some light on the function of mammalian lymph and lymphoid tissue. Popliteal lymph nodes of dogs when replaced in the popliteal space after complete severance of all vascular and lymphatic connections rapidly undergo massive necrosis. These nodes usually become infected and may slough out. When, however, all vascular connections are severed but one or more efferent and one or more efferent lymphatic channels remain intact, infection does not ensue and the nodes remain viable. Chemical analyses on lymph flowing to and from these "devascularized" nodes show a sharp drop in reducing substance, bound carbon dioxide and carbon dioxide combining power during its passage through the node and indicate that anaerobic glycolysis is one of the metabolic processes taking place in the viable node. These studies were extended to *in vitro* studies in which the nodes were perfused with artificial "lymph" at varying temperatures and pressures, and the rate of glucose disappearance (loss in reducing substance) under these conditions was compared with that of the thyroid gland under similar conditions. Both the flow through the node and the rate of glucose disappearance increased with pressure, and an elevation of 10 degrees in temperature doubled the rate of glucose disappearance. Similar changes were not observed with the thyroid gland. It is suggested that different oxygen requirements are responsible for the differences observed.

Lattice vibrations in polar crystals: R. H. LYDDANE and K. F. HERZFELD (introduced by Wm. deB. MacNider). While the question of the frequencies of vibration of crystals had been the subject of many investigations, there remained certain points for polar crystals which it was felt should be investigated. In the first place, it did not seem at all clear that the frequencies should be independent of the size and shape of the crystal, since the convergence of lattice sums involving Coulomb interactions between ions is notoriously poor. Secondly, the result for very long waves (Reststrahlen) obtained by Born seemed to contradict a result obtained by Herzfeld in an investigation in a different direction. Thirdly, it seemed of interest to obtain some idea of how the frequency spectrum of an actual crystal looked. The main part of the calculation, the finding of the Coulomb force on a particle in the distorted lattice, was accomplished by an extension of the Madelung method. With a reasonable assumption about the repulsive forces between ions, numerical values for the frequencies of a particular crystal (NaCl) were arrived at. It became also clear that the frequencies, for any actual vibration, are really independent of the size and shape of the crystal, and that the results for long waves are explainable.

Radiative loss by electrons with energies up to 2.4 million volts: CREIGHTON JONES, ARTHUR RUARK and FORREST WESTERN (introduced by Joseph S. Ames). We have studied the radiative loss of energy of electrons which make close collisions with nuclei in a cloud chamber filled with air. Four hundred meters of useful track have been employed. The energy E_0 of the primary electrons lay between 0.4 and 2.4 million electron volts, the average being of the order of one million electron volts. Previous authors found that the cross section for fractional loss greater than 20 per cent. is several times larger than predicted by the Bethe-Heitler formula, which is obtained by the Born approximation. The work of Hulme shows clearly that this approximation gives results which are much too low in the case of large fractional loss. However, in the absence of a more accurate theory we may compare our results and those of Klarmann and Bothe, using Kr and Xe, with the above-mentioned formula. Our results are in better agreement with theory than those of Klarmann and Bothe. (To a good approximation the theoretical result does not depend on atomic number in this energy region.) Several authors have suggested that discrepancies between the experimental and theoretical cross sections for radiation and for scattering require fundamental modifications in the Dirac theory. Others have suggested that such discrepancies are due to non-coulombian interaction between the electron and the nucleus. While such specific interaction may play a part in very close collisions, we believe, in view of the above results, that the main factors in the explanation are simpler and more obvious ones. Even in nitrogen, the chief difficulty in these experiments is multiple scattering in the gas of the chamber. We suggest therefore that the discrepancies are chiefly due (1) to multiple scattering, simulating energy loss; and (2) to the present lack of accurate numerical calculations of the cross section (like those of Jaeger and Hulme, referring exactly to the experimental conditions under which good measurements can be carried out.

An experimental investigation of the rôle of drive in the acquisition and performance of conditioned responses: KARL ZENER (introduced by Walter R. Miles). In recent explanations of higher mental activities by conditioned response theorists the concept of drive has played a crucial rôle. In all these explanations drive has been treated as an internal stimulus, and the nature and the conditions of establishment of its connection with the conditioned response have been considered as identical with those of any other conditioned stimulus. Certain fundamental assumptions regarding these latter points are common to the more elaborated of current-conditioning theories, but they conflict with the presuppositions of other theories of learning based on the study of presumably more complex behavior. The present set of experiments was designed to test some of the more basic of these assumptions in such a way as to differentiate empirically between the implications of these alternative learning theories. The typical Pavlovian technique was employed. The method involved periods of training for the conditioned responses of salivary secretion to food and to acid in states first of low and then of high hunger; with tests of the responses in both states of hunger during each of the training periods. Variation in hunger affects the condi-

tioned secretions based on food and on acid, as well as the concomitant overt behavior, in radically different ways. The effect of variation in intensity of the conditioned stimulus and of constant stimuli other than hunger was compared with the effect of variations in the hunger drive and was also found to be quite different. An analysis of the difference in the effect of change of hunger upon conditioned and unconditioned secretion is presented. The results are inconsistent with the particular assumptions of traditional conditioning theory which the experiments were designed to test. It is felt that they bear significantly upon the interrelation of the general problems of motivation and learning.

Factorial analysis of learning dynamics in animals: ROBERT J. WHERRY (introduced by Walter R. Miles). The number of forces which have been hypothecated to explain animal learning are extremely numerous, one writer having listed over ninety factors. Certain attempts at correlation analysis, however, have endeavored to show that all errors during learning are in large part due to a single factor present *before* learning begins. Other attempts have tried to prove that another single factor developed *during* learning controls its course. In such studies, the correlations used were between the errors on the first run and the total error scores upon all later runs as a unit. Furthermore, such studies have assumed that the factor or factors involved are of a static nature. In the present study, factorial analyses were made of the learning by animals of maze and discrimination problems. These analyses involved correlations of scores on individual trials and alleys, thus bringing out the rise and wane of different factors. Further research indicated by these preliminary analyses is suggested, and its field of probable usefulness is specified.

Recovery sequence after anesthetization. II. Cyclopropane and nitrous oxide: ALBERT C. CORNSWEET (introduced by C. L. Hull). This is a further study of the behavioral tendencies exhibited by albino rats upon anesthetization. A previous study with ether used as the anesthetizing agent was reported at the 1936 meeting of the American Association for the Advancement of Science. In the present study, cyclopropane and nitrous oxide were used. The animals were subjected to varying amounts of the anesthetics until the animals were in a complete state of quiescence. Upon removal from the anesthetization chamber, the animals were stimulated by means of a tweezers-aesthesiometer, and observations were made as to the temporal sequence of the behavioral patterning. In general, the animals portrayed a sequence of movements, in a fairly definite cephalo-caudad direction. Movements in the head region occurred before those of the caudal extremities. These results coincided with the findings of ether anesthetization. The only consistent difference between ether anesthetization and these gases was that the latter's effect upon recovery was more rapid and telescoped. Of especial importance, however, was the fact that the animals upon going under the anesthetic exhibited caudocephalad behavior movements, a sequence that was the reverse of that of recovery. This fact is contrary to medical theory of anesthetization on human subjects, where the order is, supposedly, cerebrum, spinal cord and medulla. No attempt is made to lay down any definite hypothesis, for much more experimentation remains to be done. Many investigators on pre- and post-natal behavior have tended to emphasize one part of the organism's anatomical, structural and psychological constituents more than another; at times slighting the fact that the animal is a totality, a functional whole, and more than automaton made up of discrete units. Explanations have been too reflexological, rather than in terms of an observable whole. Further work is planned, using other species of life and other types of anesthetics, and perhaps then will a comparative correlation and theory be presented.

SPECIAL ARTICLES

THE SECRETION OF IODINE BY THYROID GLANDS CULTIVATED IN THE LINDBERGH PUMP

THE form in which iodine is secreted by the thyroid is not known. The work of some investigators indicates that it is secreted as thyroglobulin. Facts observed by others can not be explained entirely on this basis.

Lunde, Closs and Pedersen[1] have found iodine to be present in normal blood in two forms. Part of it is precipitated with the proteins when these are thrown down by alcohol. Part is alcohol-soluble. The fraction that is precipitated by alcohol has been shown to be greatly above normal in the blood of patients suffering from Graves' disease, and to return to normal as the patients improve under treatment.[1] It is also greater than normal in the blood of experimental animals that have been injected with an extract of anterior pituitary.[2] The alcohol-soluble iodine does not vary much from the normal in either case. These findings, together with the fact that positive precipitin tests for thyroglobulin have been obtained in blood as it is leaving the thyroid,[3] indicate that the compound secreted is thyroglobulin. But, if this is so, it is difficult to understand how the thyroid hormone is able to affect the metabolism of all the cells of the body, for thyroglobulin is a highly indiffusible substance. Moreover, Dodds, Lawson and Robertson,[4] on examining the blood of a large number of patients suffering

[1] G. Lunde, K. Closs and O. C. Pedersen, *Biochem. Zeit.*, 206: 261, 1929.

[2] K. Closs, L. Loeb and E. M. MacKay, *Jour. Biol. Chem.*, 96: 585, 1932.

[3] A. J. Carlson, L. Hektoen and R. Schulhof, *Amer. Jour. Physiol.*, 71: 548, 1925.

[4] E. C. Dodds, W. Lawson and J. D. Robertson, *Lancet*, 2: 608, 1932.