THE PSYCHOLOGICAL BULLETIN

GENERAL REVIEWS AND SUMMARIES

TROPISMS AND INSTINCTIVE ACTIVITIES

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Comprehensive Studies.—Jones's book (14) is a popular, interesting account of the ancestors of man, who became arboreal probably early in the mammalian age, and of the influence of arboreal life upon every part of the organism, especially the nervous system.

Szymanski's long paper (42) consists of twelve distinct articles, grouped in three parts. 'I. Beobachtungen und Versuche über Angeborene Handlungen.' (1) The worm *Tubifex* (pp. 2-33). If all animals be divided into the optical, the osmotic and the tactile, this worm is an extreme example of the tactile: living with its head buried in its nutriment (mud), it has little use for distance-receptors. (2) In an insect larva (*Arge*, a saw-fly), arousal of the fear reaction, even amputation of a leg, has no effect upon the rate of heart-beat (pp. 33-37). (3) "Ueber Abwehrreflexe bei Raupen" (pp. 37-48). This is a study of the phylogeny of a reflex. It is traced back to "Probierbewegungen." Perhaps all reflexes, like voluntary acts, are secondary phenomena, having evolved by selection from varied movements (Jennings) which constitute the *Grundlage* of all behavior. (4) "Ueber Putzreflexe bei Insekten" (pp. 49-86). Each species of insect cleans especially that sense organ, whether eye, antenna, or mouth-part, which is most used by it. Insects make movements to clean the sense organs while awaking from a state of etherization; thus the deficiency of excitation caused by the action of ether on the nervous system is projected outward, by the law of "excentric localization" as if it came from

the sense organs. (5, 6, 7) (*v.i.*, under *Cycles*.) "II. Versuche über die Entstehung der rezeptorisch-motorischen Gewohnheiten." (1) (Pp. 127-157) Dogs failed to distinguish between a plain black wall and a black wall with a white pyramid drawn on it. (2) (Pp. 157-197) A study of the disappearance of habits. (3) (Pp. 197-220) A series of tests of rats learning a maze, leading to the conclusion that the reduction of errors to zero is not due to mere repetition but requires a "vital interest" such as hunger. "III. Allgemeine Betrachtungen über das Verhalten der Tiere. (1) Körperstellungen als Ausdruck innerer Zustände der Tiere" (pp. 220-237). The principal attitudes are sleep, rest and readiness, the last showing a few principal varieties. All can be grasped under the concept of attention. Attention must be given a biological definition. It is a setting of the organism for the reception of certain stimuli. Sleep is negative attention. In the sleeping attitude, each form protects its most important sense organ; *e.g.*, insects protect the antenna. (2) "Der Umfang der rezeptorischen und Aktionssphäre" (pp. 237-244). The author states (but the reviewer does not agree) that in most animals, perhaps in all, even including man, the "action sphere" is restricted to actions that are inborn, hence is narrowly limited, whereas the "receptory sphere" is comparatively unlimited.

Wheeler (49), from a survey of parasitism in wasps, bees and ants, concludes that in this group a parasitic species evolves from the host species itself. Some individuals within a species take to robbing others of the food destined for the larvæ. The parasitic habit thus started continues, by a "circular process." The parasite becomes a distinct species. In time, it exterminates its host. It gradually transfers its attentions to a new but related host.

Tropisms, Taxes.—Crozier and Arey (8) find that *Onchidium* in the laboratory is always photonegative. Yet in nature it is diurnal. Its heliotropism is, the authors think, of no use, and is, in the natural habitat, centrally inhibited by other stimulations. Piéron (28) finds that limpets, in homing, when on rough rocks, are guided mostly by the relief of the rock surface (tactile), less by the inclination toward the vertical (weight), least by the direction of light rays. On smooth rocks they rely on the last two factors. It is interesting to compare these two studies, on *Onchidium* and on the limpet.

Grave (10) finds that in the ascidian which he studied the free-swimming period is of short duration—ten minutes to two

hours. The larvæ are positively heliotropic for a brief interval at first. Becoming negatively heliotropic and probably positively geotropic, they descend and become attached.

Rabaud (29) finds that a myriapod (*Schizophyllum*) moves from lighted places into dark; but does this neither by a tropism nor by differential sensibility. It is phototactic, but not phototropic. It is "stenophote," living in the dark; whereas animals that flourish in the light are "euryphote."

Riley (31) studied the problem, What becomes of apterous water-striders if their pool of water dries up? Some of them, traveling overland, succeed in reaching other pools, but many die. Weese (48) finds that the horned lizard reacts more definitely to a gradient of soil temperature than to one of air temperature.

Small (36) finds that in a plant, *Vicia Faba*, geotropism of the root-tips obeys Weber's law, and does not require statoliths but is due to differential increase in the permeability of the protoplasm to ions, which is detected by increase in electrical conductivity. This change in the protoplasm resembles that in a contracting muscle.

Righting Reactions.—Szymanski (44) observed how beetles, when turned on their backs, regained the normal position. In sixty species he found twelve different methods. But in each beetle there are several variations of the method of turning over; they are tried in turn until one of them produces the end-effect.

Locomotion.—Copeland (5) gives convincing evidence that the locomotion of the mud snail *Alectrion* is due to ciliary movement. Stimulation of the tentacles induces movements of the pedal cilia, showing that the latter are, directly or indirectly, under control of the nervous system. Crozier (7) adds a new type of locomotion to those known among gastropods: in *Xenophora* the foot is advanced, is attached by suction, then draws the shell forward.

Müller (25) has made an extended study of a crustacean resembling *Branchipus*. The rate of movement of the swimming feet varies directly with temperature and light, and inversely as the viscosity of the medium; it decreases with age.

Stellwaag (39) studied the means by which insects steer during flight. Some investigators had claimed that they steer by shifting the center of gravity; as, by moving the abdomen. The author took shadow photographs of flying insects, and found that the abdomen does not move. He studied the wing movements, and saw that the two wings, though always synchronous, may move in different planes and with different amplitude.

Szymanski (47) points out that every rain which falls on a meadow isolates many insects on tiny "islands." Various insects escape from these islands by flying, jumping, swimming, running on the surface film, crawling under water. The swimming movements of ants are complex and highly adaptive.

Grave (10) finds that Ascidian behavior is not so similar to that of vertebrates as has been assumed. The free-swimming larva swims with constant rotation on its long axis.

By an examination of the mechanism of flying-fishes, Ahlborn (1) shows that they cannot fly, except by momentum.

Migration.—Baldwin (3) has inaugurated a new era in bird-banding by systematically trapping the birds. He has discovered that individuals winter in successive years in the same winter quarters; that yearlings return to the locality where they were hatched; that a pair of wrens, after rearing one brood, became "divorced," each finding a new mate and rearing a new brood.

The title of Bretscher's paper (4) may be misleading. His thesis is that bird migration occurs when the time has come, regardless of weather. He seems successful in proving that migration is independent of temperature as such. But Smith (37) finds that migration records (of all species massed together) show high correlation with barometric conditions and favorable winds

Cycles.—Szymanski continues his studies of the daily cycle: in earthworm, snail, crayfish, blow-fly, rabbit, cat, dog (46); in tree-frog, ringed snake, jackdaw (42, sections I, 5, 6 and 7); in white rat, dancing mouse (43); in the human infant (45). The ringed snake showed activity regularly at midday, which must have been due to inner factors, for it was not due to hunger nor temperature. Adult man is an "optical" animal, and as such is "monophasic," with one period of activity and one of rest in the nycthemeron. But the human infant, 1 to 10 days old, is "polyphasic," with 5 or 6 periods of activity; it is a "tactile," resembling the earthworm.

Rhythm.—Snyder and Snyder (38) have solved, at least in great part, the problem of the synchronous flashing of fireflies. Observing for several seasons, they saw on a few occasions that the fireflies did flash synchronously. They found that the rate of flashing increases as the temperature rises. At a given temperature the rates of many individuals are nearly identical. This gives a basis for synchronism. "On the other hand, as far as the individual beetle is concerned, the synchronous flashing would be purely accidental and utterly devoid of any relation to a higher

intelligence or to instinct or any community activity." These findings are similar to those of Shull on the synchronous chirping of crickets.

Swindle (41) tells us that he has "many pounds of kymograph records," and he gives a few samples, but he does not tell precisely what data these represent. He states that a cockatoo can be trained to beat simultaneously in four different rhythms, with 5 to 11 beats in the measure. This remarkable feat will excite the envy of our rag-time pianists and our jazz dancers.

Defense.—Crozier and Arey (9) find that the snail *Onchidium floridanum* exhibits two types of coloration which the authors think inexplicable either as concealing or as warning colors. This species has repugnatorial glands which, when the animal is touched, shoot their irritating contents with some accuracy toward the stimulating object.

Cowles (6) observed that hermit crabs, on changing to a larger shell, seized the sea-anemones which were on the old shell and transferred them to the new one.

Pantel and Sinéty (27) studied behavioristically the whole subject of pigmentation change in phasmids. Many facts in the rearing of the young favor the theory of color adaptation: the color harmonizes with that of the substratum, even when the substratum does not supply the nourishment. Adaptation is effected partly by the insect traveling to the substratum of its choice.

Siedlecki (35) reports field observations on the "terrifying" attitude.

Immobility.—Rabaud (30) finds that "death feigning" is only a special case of a reflex immobility which is found in some degree in all arthropods. The arousal from immobility is due to an antagonistic reflex. Both the immobilizing and the mobilizing stimuli are tactual. The chief zones of the former are on the cephalothorax. The chief zones of the latter are the soles of the tarsi and the tip of the abdomen. Thus an insect holding firmly to the substratum, with tip of abdomen touching the substratum, resists immobilization. The entire integument is replete with sense organs connected with motor-excitatory and -inhibitory centers, the latter being more at the anterior end, the former at the posterior. Reflex immobility is only an exaggeration of the normal functioning of these paths, an exaggeration of muscular tonus. Reflex immobility resembles sleep, differing chiefly in the greater muscular tension.

Szymanski (44) finds that in beetles the "hypnotized" con-

dition differs from death feigning in that the former is passively, the latter actively assumed. Death feigning in its highest development is accompanied by structural modifications, the insect drawing its legs, tortoise-like, into recesses in the trunk.

Fear.—Griffith (11) observed that white rats, on seeing, hearing and smelling a cat for the first time, showed extreme fear. This fear might have been due to the feline odor specifically, or merely to its unfamiliarity. Kunkel (20) observed that his white rats showed fear on first perceiving the odor of a cat, but not on first perceiving the odor of a rabbit, from which he concludes that the fear is aroused by the feline odor specifically.

Physiology.—Moore (23) finds that castrated rats with implanted ovary show typical maternal behavior; spayed females with implanted testis show typical male behavior.

Ultramare (26) reports that rabbits, guineapigs, cocks, pigeons, tortoises, frogs, tritons and fish have been kept in a dark room, some of them more than three months, with no profound effect on their vital condition. They show decrease of waste products and of muscular activity, and increase of stored nourishment, these physiological conditions being due to a reflex from the retina. Pantel and Sinéty (27) report that phasmid' larvae which were experimentally blinded, by a non-traumatic method, showed an unfavorable physiological effect, indicated by change in the number of molts and in the rate of transformation.

Neurology.—Arey and Crozier (2), from a study of the behavior of *Chromodoris*, conclude that the gill crown and some other parts are controlled by a "nerve net."

Moral (24) finds that the effect of some anesthetics is greater at high temperature. This may be due to differential solubility: at high temperature these drugs are relatively more soluble in lipoids, hence pass into the nerves; at low temperature they are relatively more soluble in water, hence pass out of the nerves. Certain other anesthetics show the reverse phenomena.

Komine (18, 19) is using non-protein nitrogen in the brain as a measure of catabolism.

Riddle has a strain of ataxic pigeons descended from a female that was reproductively overworked. Hoshino (13) finds that the brain in these birds anatomically resembles that in hereditary ataxia in man. Koch and Riddle (16, 17) find that the ataxic brains are chemically underdeveloped. They have made out (17) an "age series" of normal pigeon brains, showing that chemical

differentiation follows the same course in the pigeon as in the rat and man.

Kuntz (21) finds that the sympathetic nerve fibers in the ovary and in the testis of the dog supply no cells nor tissues except the muscle fibers. Rogers (33, 34) shows that in the pigeon removal of the thalamus destroys the temperature-regulating mechanism. Wintrebert (50) observed that *Scyllium* commences automatic rhythmic movements at an early embryonic stage. These are independent of the nervous system. Control of muscle by nerve is established gradually.

Meltzer and Githens (22) were able to abolish "voluntary movements and the sensation of pain, without affecting reflexes" in dogs by a blow on the cranium. In such animals, nose-licking persists, indicating that it is a reflex. It may be induced by compression of the nasal septum, but the licking occurs only when the compression has ceased. Apparently the compression stimulates simultaneously two antagonistic sets of fibers, exciting and inhibiting, the former having an efficient after-effect.

Philosophy.—Hooker (12) presents the idea that organisms exhibit two fundamental processes: behavior and assimilation. In behaving, they react according to the theorem of Le Chatelier. In assimilating, they perpetuate themselves by autocatalysis. Kappers (15) points out interesting analogies and relations between the phenomena of growth and nervous and conscious action.

Sumner (40) shows reason to believe that the principle of trial and error can be given a still wider application than it has had. It will help us to explain the most difficult cases of adaptation and "organic purposefulness," including those of regeneration. "We may suppose the organism to be in a condition of 'unrest' until the end is achieved." Even the Lamarckian principle involves selection, because "modifications produced by the environment are in the nature of reactions to stimuli," and all reactions are selective.

Ritter (32) emphasizes the unity and continuity of the living organism. We should study the organism as a whole, not only in parts; in nature, not only in the laboratory. Both analysis and synthesis are needed. He emphasizes also individuality and specificity. He gives (vol. 2 pp. 246-274) a number of interesting descriptions of instinctive behavior.

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SENSORY PHYSIOLOGY OF ANIMALS

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The literature for the year indicates some revival of interest in animal behavior after two years of short commons. As usual the bulk of material deals with photic sensitivity, but it is marked by a tendency to turn from type studies of tropisms to an analysis of pattern vision in invertebrates. Labyrinthine function occupies second place in number of studies, perhaps as a result of the general interest in problems of aviation.

In the bibliography a few papers which have not been available to the reviewer are included in order to bring the references up to date. These are marked by an asterisk.

General Studies.—Szymanski (60) distinguishes between dynamogenic (antreibenden) and effective stimuli in relation to animal learning. The former, as hunger, increase excitability; the latter direct the organism's reactions. The rate of learning varies with the character of the dynamogenic stimulus. Buddenbrock (8) also emphasizes the dynamogenic effect of sensory stimulation in a study of the function of the "balancers" of diptera. He tested the function of these organs in a variety of ways. Their importance varies in different species but, in general, their removal results in a reduction in speed and especially in the amplitude of the movements of the wings. Consequently flies deprived of balancers are either unable to rise or to continue flight; although they may steer and balance in a normal manner for short distances. In some species removal of both legs and balancers inhibits movements of the wings although insects with either legs or balancers can fly in a normal manner. Hence the author concludes that the vibrations of the balancers serve solely to excite afferent impulses which reinforce the innervation of the wings.

Arey and Crozier (2) give an extensive account of the natural history and sensory reactions of *Chiton*. The molluscs are sensitive