

assistance from still other of the sixty Canadian museums.

HARLAN I. SMITH

DR. EDWARD HINDLE

TO THE EDITOR OF SCIENCE: In a review of Dr. Edward Hindle's book on "Flies in Relation to Disease—Bloodsucking Flies," by Mr. W. D. Hunter, printed in the issue of SCIENCE for July 16, there occurs the erroneous statement that Dr. E. Hindle met his death in Africa. Dr. Hindle is alive and well and occupies the position of divisional signal officer with the rank of first lieutenant in the Royal Engineers. He is expecting to leave for the front at any moment. It is clear to me that confusion has arisen through the death of Mr. Gordon Merriman, who likewise belonged to my laboratory staff. Mr. Merriman was killed while fighting in Nyasaland. Dr. Hindle has never been in Africa, although before the war we planned for him to go there on a scientific expedition.

Having received many inquiries, from different parts of the world, owing to the misstatement in SCIENCE, I shall be much indebted to you if you will kindly help me to quiet the apprehensions of Dr. Hindle's numerous friends by correcting the error referred to.

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CAMBRIDGE,
October 10, 1915

SCIENTIFIC BOOKS

Bodily Changes in Pain, Hunger, Fear and Rage; An Account of Recent Researches into the Function of Emotional Excitement. By WALTER B. CANNON. New York, D. Appleton & Co., 1915. Pp. xiii + 311.

The Origin and Nature of the Emotions, Miscellaneous Papers. By GEORGE W. CRILE. Edited by AMY F. ROWLAND. Philadelphia, W. B. Saunders Co., 1915. Pp. vii + 240.

It is not altogether an accident that these two volumes, covering ground in many respects very similar, should appear at the same time. For a number of years, and particularly since the publication of Pavlov's work on the effects of emotion upon glandular action, there has been a wide and increasing interest among psy-

chologists and physiologists in the more intimate bodily mechanism underlying emotional processes. This movement has coincided with a rapidly growing appreciation among physiologists and physicians of the organic significance of certain of the so-called ductless glands, and of the physiological importance of gland and muscle tissue in general. Already the discoveries made have quite revolutionized many of the ideas of a generation ago, and the chapter seems hardly more than begun.

Despite the similarity of the two books, it will be convenient to discuss them separately, and we may first consider Dr. Cannon's work, which represents a series of researches carried on by the author in collaboration with a number of his colleagues to whom the book is dedicated. The work gives every internal evidence of having been done with great care and intelligence. The technique pursued is adequately described; the dangers and limitations to which it is exposed are frankly recognized, and the inferences and generalizations proposed are thoughtful and on the whole conservative. The only strictures which a psychologist might be tempted to pass would relate to the large psychological literature on the organic accompaniments of affective states, which is to all intents and purposes wholly disregarded. This may be because it was thought to have no bearing, but to the reviewer this position would hardly seem tenable. In any event, Dr. Cannon's work is written in a manner to inspire the highest respect for its conclusions, whether one wholly agree with them or not.

The essential positions of the author may be summarized in a few propositions, which nevertheless represent very extensive experimentation both of his own and of other scientists. The great divisions of the autonomic system, *i. e.*, cranial, sympathetic and sacral, represent three largely distinct functions in the economy of the organism. The first has to do with the storing up of reserves of energy for times of need, as is represented in the slowing of the heart beat under stimulation of the cranial connections of the vagus. The second is the great defensive organ through whose activity these reserves are rushed to the front

when needed. This is illustrated by the violent beating of the heart in anger, and by other activities of the organism discussed more fully below. The third has mainly to do with the preservation of the species, and involves the action of the sexual organs.¹

Dr. Cannon points out that the sympathetic division operates antagonistically and inhibitive in its relation to the other two divisions, stimulating organs which they depress, or *vice versa*. Broadly speaking, it is the more imperious in its demands, and is likely, when in action, to dominate the others.

In connection with the operation of the sympathetic under the influence of pain or great emotional excitement, certain highly interesting glandular effects are observed. Adrenin is secreted and thrown into the circulation by the adrenal glands; additional sugar is also found in the blood. Experiments show that the adrenin is a powerful antidote to fatigue phenomena, and that it tends to drive the blood away from the abdominal organs into the lungs, heart and skeletal muscles, and that under its influence breathing is made deeper. It may be added that with these general conditions blood is found to clot more rapidly than under normal circumstances.

It has of course been a matter of general knowledge for generations that emotional excitement releases resources of muscular energy much in excess of those ordinarily at disposal. Human achievement in battle, in exciting sports, in terror and rage are all instances of this. These researches and others cited in support of the conclusions reached indicate more exactly the mechanisms by which the commonly observed results are actually brought about. Especially do they tend to magnify the office of the adrenal glands, organs whose functions have until recently been shrouded in mystery.

In common with other leading physiologists Dr. Cannon regards the sensation of hunger as due to contractions of the stomach wall in

contra-distinction to the other hypotheses in the field; *e. g.*, the theory that hunger is a general bodily sensation, that it is due merely to emptiness of the stomach, that it arises from hydrochloric acid in the empty stomach, etc. The chapter dealing with this topic, while intrinsically interesting, at first sight articulates with the rest of the volume somewhat indirectly. But when the distinction between appetite and hunger is remarked the relevancy of the material to the general theses of the book becomes apparent. Appetite has to do with suggestions of the agreeableness of food, in which sight, taste, smell and the activity of memory are definitely implicated. Hunger is a painful process which often, indeed generally, coincides with appetite, but it may exist without it, or may be wanting when appetite is present. Hunger springs from a definite local source, and involves vigorous action of the sympathetic. Appetite is more definitely psychical, and involves the cranial autonomic rather than the sympathetic. This distinction in the case of hunger and appetite affords a moderate instance of the antagonistic emotional interrelations which are often much more extreme and intense. Dr. Cannon elaborates these antagonisms by exhibiting various emotional expressions in which the sympathetic system is shown acting in vigorous opposition to the cranial and sacral. Perhaps the most striking instance is that of sexual emotion which despite its overwhelming power when once aroused can be inhibited absolutely by such activities of the sympathetic as are represented in fear and anger.

The author annexes as a final chapter to the book a discussion of alternative satisfactions for the fighting instincts and emotions. One is reminded of William James's brilliant paper on the moral equivalents for war. Like James Dr. Cannon concludes that the fighting instincts are too deeply inbred to be speedily exterminated, even if such extermination were thought wise. In order that they may not be perverted nor yet allowed to occasion unlimited human misery, by their normal expression, he advocates athletic competition of all kinds, and especially international games. The issue here

¹ One may suppose that Dr. Cannon does not regard as important the suggestions of certain scientists that these organs are in fact largely controlled by plexuses derived from the sympathetic.

raised stands on the whole somewhat apart from the main doctrines of the book and need not be further considered in this place.

Considering the work as a whole, the reviewer has only one caveat to offer, and that relates to the critique, both implied and explicit, upon certain features of the James-Lange theory of emotion. Taking Professor James's somewhat playful announcement that we feel afraid because we tremble or run away, a good deal of futile criticism has been expended in attempts to disprove the doctrine. The really significant feature of James's contention has by most of these assaults been left wholly unscathed; *i. e.*, the doctrine that the peculiar *modus* of emotion, as contrasted with other mental states, was to be found in the dominant part played therein by the reflex elements arising from bodily and especially from visceral sensations. Criticisms such as those of Sherrington and Cannon rest on altogether more substantial foundations than the earlier objections, and deserve more serious consideration. Sherrington has maintained, on the basis of his "spinal dog" that emotion may perfectly well be experienced when all connection of the brain with the viscera is estopped. Dr. Cannon maintains that the visceral agitation is very similar in many otherwise dissimilar emotions, and that in consequence we must abandon hope of finding in visceral sensations any *differentia* for the various emotions.

Reflexes of the facial and cranial muscles, by which in part at least Sherrington must have judged the presence of emotions in his dogs, are also instinctive and that is really James's important point, not that the reflexes are exclusively visceral. Visceral excitement, especially that of cardiac and respiratory character, undoubtedly often gives emotion its body and bulk. Moreover, even in emotions much alike in many respects and showing many visceral similarities, it is not clear that there are not abundant other differences, extending to the reflex conditions of the general skeletal system, and in no wise directly dependent upon purely cerebral activities. Sickening fear in the face of imminent peril has in it not a little

in common with the breathless excitement of the lover about to receive the first kiss of his beloved, but it also has many points of difference. In both there may be a fluttering of the heart and a quickened spasmodic breathing, but in the first there is generally relaxation of the tonus of the entire skeletal system; in the latter instance quite the contrary may be the case, and the skeletal system may be toned to an extremely high pitch.

Until it is shown that consciousness is not characteristically modified in emotion by excitation reflexly aroused whether in skeletal muscles, glandular activities or visceral organs, the main point of James's doctrine will stand firm. Neither Cannon's nor Sherrington's contributions seem to the reviewer to accomplish this.

Dr. Crile's volume, comprising eight addresses delivered from time to time during recent years, is much more loosely integrated than the studies by Dr. Cannon. The essays vary greatly in present value, and connect themselves with the subject of the emotions in very different degrees. One gets the impression that Dr. Crile either is not widely read in modern psychology, or that he attaches very slight value to its literature. Certainly the essay entitled "The Mechanistic View of Psychology" suggests only the slenderest acquaintance with the contemporary views on this issue, and contains, so far as the reviewer has observed, no material not already more forcefully expressed by other writers, especially by Dr. Loeb. In one passage,² he says: "Could we dispossess ourselves of the shackles of psychology, forget its confusing nomenclature, and view the human brain, as Sherrington has said, 'as an organ of, and for the adaptation of nervous reaction,' many clinical phenomena would appear in a clearer light." It is not clear what special psychological shackles Dr. Crile is dragging, but the reviewer is at a loss to think of any psychologist of note who would for a moment call in question the formula quoted from Sherrington. Meantime the book, which in portions is over-illustrated with cuts of the kindergarten type, contains a large amount of

² P. 48.

admirable material gathered by Dr. Crile and his fellow workers. Much of this is put in fresh and interesting form, but many of the inferences and conclusions based on the facts appear at best quite imperfectly substantiated, and the reader more than once feels the absence of that logical sobriety and reserve which gives Dr. Cannon's book so scientifically satisfactory an atmosphere. Perhaps the most significant facts cited by Dr. Crile are connected with his brilliant surgical experiments on anesthetics and particularly on the use of cocaine to block spinal cord conduction.

In the opening essay on phylogenetic association in medical problems, the main doctrine presented is that racial history has determined the kind of responses made to injurious and threatening stimuli, most of them expressed in emotional activities, and that these resemble in their cerebral cortical consequences the effects of ordinary surgical shock. The latter is found productive of brain injury in ether anesthetization, despite the painlessness of operations under these circumstances; in less degree with nitrous oxide, and to all intents and purposes not at all with his own anoci-association methods of cocaine injection in the spinal cord. Many side issues are touched upon, for example, the phylogenetic history of the struggle between bacteria and their hosts, the history of fear as phylogenetic struggle, etc.

Then follows an address on phylogenetic association in relation to emotion, presenting a doctrine of essentially Darwinian character. Emotion is a vestige of an old and formerly useful act now partially or wholly inhibited and aborted. The author comments suggestively on the alleged fact that animals which have no natural weapons for attack experience neither fear nor anger, while animals which have weapons of attack express anger particularly by energizing the muscles used in attack.

The essay on pain, laughter and crying again evinces either lack of familiarity with, or profound distrust of, the extensive psychological literature dealing with the second phenomenon at least. The doctrine of the protective character of these acts is further developed, and

pain is identified as a motor phenomenon with the repeated discharge of brain cells; crying and laughter furnish drainage for dammed up excitation not otherwise conveniently disposable.

The paper entitled "The Relation between the Physical State of Brain Cells and Brain Functions" is an exposition of the doctrine that the cortical cells show most injury in all forms of organic disorder involving the higher mental functions. The essay on the "Mechanistic View of Psychology" has already been referred to.

The essay on the "Mechanistic Theory of Disease" formulates a conception of organic processes which, so far as the reviewer can detect, is substantially identical with that offered by Descartes in 1664.

An address on the "Kinetic System" is a long and rather loosely organized discussion of the thesis that "there is in the body a system evolved primarily for the transformation of latent energy into motion and into heat. This system I propose to designate 'the kinetic system.'"³ The principal organs of this system are the brain, the thyroid, the adrenals, the liver and the muscles. "The brain is the great central battery which drives the body; the thyroid governs the conditions favoring tissue oxidation; the adrenals govern immediate oxidation processes; the liver fabricates and stores glycogen; and the muscles are the great converters of latent energy into heat and motion." The essay is devoted to a citation of evidence from various sources to substantiate these conceptions, with the constant context that the adaptation of animals to environment involves transformations of energy, in which the organs named are the all important factors.

The final address on alkalescence, acidity and anesthesia is a defense of the doctrine that life depends on the maintenance of normal potential alkalinity and that anesthesia is primarily a function of increasing the acidity of the organism.

The volume as a whole suggests an intelligence of unusual originality and force, somewhat hurriedly and with undue disregard of

³ P. 174.

the large relevant literature of the subject, dealing with ideas which richly deserve a more leisurely and scholarly development. It is to be hoped that Dr. Crile may in the near future find time for such a treatment.

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SPECIAL ARTICLES

A STERILE SIPHON TIP PROTECTOR

THE tip of a siphon supplying sterile water, physiological saline solution, or diluent (0.4 per cent. tricresol in 0.85 per cent. NaCl solution) for various bacteriological procedures must be protected from contamination by dust, flies or other unsterile objects. This is accomplished fairly successfully with a bell-shaped cap such as can be made by cutting the bulb of a 50 c.c. volumetric pipette in the middle, leaving attached to each bell a tube 5-7 cm. long for union with the siphon tube, and drawing into this tube by means of a suitably sized rubber hose, another glass tube of such size that when the rubber hose is released its elasticity binds the two together. The covered end of the smaller tube is then adjusted even with that of the bell tube and the rubber hose snipped off, or in fact used to connect to the siphon of the bottle.

But such a device, while giving a fair protection during use, does not prevent the lodgment of upwardly floating particles of lint upon the drop of liquid at the point. It is this protection which the following addition accomplishes.

A test tube about 2.5 cm. $\times$ 15 cm. may usually be found to fit outside or inside the bell, as above prepared. The lip is removed and upon the tube is placed a thin rubber finger cot or a finger of a rubber glove from which the closed end has been cut so that the portion which is left may be rolled upon the bell from the tube thus holding the two together and preventing lodgment of contaminating dust when the siphon is out of use. During use the protector may itself be protected by fastening it to another test tube. However, this is scarcely necessary, and I have ordinarily taken no particular precautions to

sterilize or prevent contamination of the protector since it touches the bell only and not the siphon tip itself. Yet in certain permissible cases a few drops of formaldehyde in the protector have added a further element of safety.

One of the special purposes to which I have successfully adapted such a device is the frequent examination of bacterial broth cultures being studied for progressive metabolic and morphological changes. For example, some of the fluid from a liquid preparation of *B.*

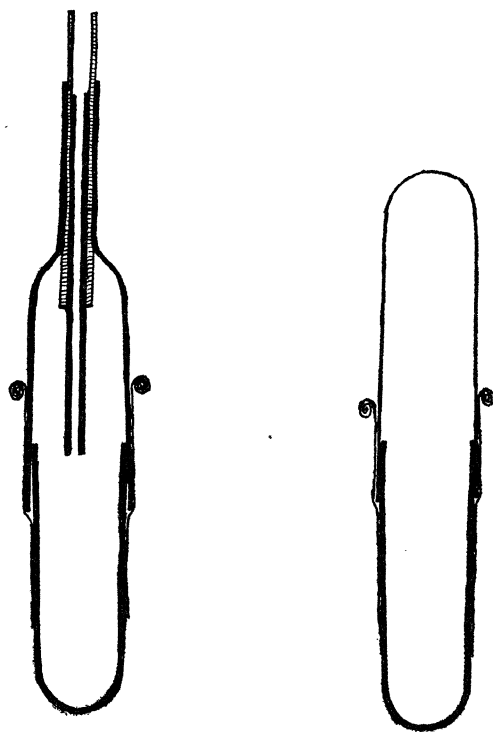


FIG. 1.

diphtheriae was withdrawn every four days for a period of three weeks, microscopic and cultural examinations made at each withdrawal confirming the continued purity of the contained culture.

Fig. 1 shows a diagrammatic cross section of the apparatus set up (A) and taken apart (B), for use of the siphon.

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