dane in "Respiration," recognizes that correlation and regulation are the prime problems of physiology.

The investigations by the author and his pupils, which form the larger part of the subject matter of this book, arose from the problem of the mechanism by which the exchange of substances and especially oxygen is effected between the blood and tissue elements. How is this function regulated, and adapted to the ever-changing needs and coordinated with the multifarious activities of the living body? The answer, which is one of the most beautiful of recent discoveries, is that in such a tissue as muscle there are many times as many capillaries as are ever opened simultaneously to the blood flow during rest; and that now one, now another channel is opened for short periods, to close again as yet others open. This alternation of dilatation and constriction is under a control which is largely local and is clearly dependent upon the needs of the immediately surrounding tissue elements. Only with the passage from rest to the activity of muscular work are all, or nearly all, of the capillary channels dilated. The surface for diffusion of oxygen and other nutriment is thus varied and adapted to the needs of the working muscle fibers. Spreading along and around the capillaries are the contractile elements which Krogh, in generous recognition of the investigator who first saw them, terms Rouget cells.

From the investigations of Krogh and his pupils and the work of others, which is fully reviewed, it is shown that the capillaries are contracted and dilated independently of the arterioles, and thus form a mechanism independent, in large part at least, from the vasomotor mechanism of Claude Bernard and Ludwig. Beside the heart and the vasomotor (arteriomotor) mechanism we must recognize a third and no less important factor in the circulation, consisting of the capillariomotor mechanism: a conception which the reviewer urged as necessary years ago (on much less conclusive evidence however) and called the "venopressor" mechanism, but which was then too unorthodox for some authorities.

Many suggestive observations are here reported also on the reactions of capillaries to stimuli on their part in herpes zoster and erythema, and on their behavior under the influence of heat and cold and in reaction to chemical substances, and especially to histamine.

These investigations do not yet solve the problem of functional hyperemia—the cause and mechanism of the dilatation of all the capillaries of a muscle, for instance, when it is working. But they formulate clearly the problem and take a first step towards its solution; for the discovery is reported and established of a special hormone, identical apparently with that in pituitary extract, which exerts, above every other substance tested, a capillary dilating power.

Two lectures are devoted to the topic of the exchange of substances through the capillary wall—a topic of fundamental importance, upon which many keenly conceived and beautifully executed observations are described, together with stimulating new conceptions of the process of intravital diffusion.

In the last lecture the parts played by capillaries in various processes in health and disease are discussed. The topics include the absorption of dissolved substances from the small intestine, the regulation of the aqueous humor of the eye, inflammation—that supreme problem of pathology, circulatory shock—a scarcely less interesting problem for physiology, and finally the formation and reabsorption of edema.

Clear in conception, method and presentation, and beautiful in the technique both of the laboratory and of the printing press, this book is indeed a worthy addition to the scientific classics which have been published as Silliman lectures. It presents investigations already crowned by the Nobel prize.

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Tobacco and Mental Efficiency. M. V. O'SHEA. Macmillan Company, 1923, pp. xx and 258.

THIS is a general and popularly written report of the outcome of various inquiries supported by the "Committee to Study the Tobacco Problem." It is an unbiased account of the present state of our knowledge concerning the title subject.

The first third of the book gives an interest-

ing survey of the tobacco habits and opinions of prominent men and women, and cites testimonials typical of those received from several hundred distinguished persons, both smokers and non-smokers. The net results are (a) that such reports do not yield reliable information concerning the influence of tobacco; (b) that unexpected numbers and natures of people smoke; (c) that there is a general objection to the juvenile use of tobacco.

A second section of the book reports studies of the correlation between school work and the use of tobacco. Questionnaire returns and statistical studies, which are cited, show that, on the whole, school men agree that smoking and scholarship are incompatible, but the causal relations are obscure. Comparison of scholarship records with smoking proclivities yields a correlation of —.51. Among high school boys examined the smokers were found to be superior in intelligence tests. They thus fail to live up to their possibilities and the teachers put a good share of the blame on tobacco. Of course a correlation does not reveal causality, but it would at least appear from the data that something is operating to disinterest the more intelligent boys in scholarship and to attract them to tobacco.

Realizing the insufficiency of the foregoing data, the author devotes the last third of the book to a survey of the experimental studies of Dr. Clark L. Hull, detailed report of which is promised in a forthcoming monograph. With well-controlled technique, experiments were conducted on eighteen men college students to determine the effect of pipe smoking on twelve different work processes.

On seven of these tasks the average results are so small or so equivocal as to be negative or uncertain. Steadiness, accuracy in cancellation and facility in learning show impairment. Pulse is increased in rate and motor fatigue is lessened (the sign for muscular fatigue average on page 222 should be + instead of —). The net result is loss rather than gain in performance. The book concludes with a judicious summary of conclusions and a fifteen page bibliography of English books and articles. Throughout the book is distributed also a good deal of discussion concerning the possibility of influences not yet experimentally demonstrated.

In common with most studies of drug effects, individual differences are noted and it is time that such idiosyncrasies be more fully analyzed. Drug investigations already reported provide data which suggests very clearly an inverse relation between susceptibility to drugs and general mental competence. If these indications are reliable it is not "people of distinction" and college students, but instead the mediocre and the natively inferior who may best reveal the characteristic direction and nature of drug influences.

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SPECIAL ARTICLES

ON AN APPARENT EFFECT OF THE SUN'S ELECTRICAL CHARGE ON THE YEARLY VARIATION OF ATMOSPHERIC POTENTIAL GRADIENT

IT has long been known that the electrical potential gradient in the atmosphere undergoes an annual variation, being greater in winter than in summer. It seems still to be generally believed that this variation is due to a corresponding variation in electrical charges situated somewhere in the atmosphere, though all attempts to locate these charges have failed. On the other hand, Erman[1] showed in 1803 that all known phenomena of atmospheric electricity could be explained as due to induction by a negatively electrified earth. A similar theory was proposed by Peltier in 1836. In 1874 Sir William Thomson (Lord Kelvin) in his presidential address before the Society of Telegraph Engineers said:[2]

> I do not say too much, then, when I say that the statement that the air is positively electrified has been at all events a subject for ambiguous and contradictory propositions; in fact, what we know by direct observations is that the surface of the earth is negatively electrified, and positive electrification of the air is merely inferential.

And again,

> The result that we obtain every day of fair weather in ordinary observations on atmospheric electricity is precisely the same as if the earth were electrified negatively and the air had no electricity whatever.

1 Gilbert's Annalen, xv, 386.

2 *Soc. Telegraph Eng. Jour.*, Vol. III, p. 12.