might be purely mechanical and analogous to the control of one vibrating body by another, the medium of control in this case being the sensitiveness of one insect to the stridulations of another. But the fact that they often start all at once seems to bar out this hypothesis, and, indeed, is a fact difficult to account for in any way.

As to the pitch, it certainly seems as if one 'orchestra' were from a semitone to a tone removed from the other, but, as Mr. Scudder suggests, this may be only apparent. In case it is real, however, may it not be due to the falling into beat of each insect with those to whose stridulation it is most sensitive—namely, those that produce sounds approximating to its own in pitch? ARTHUR P. BOSTWICK.

NEW YORK, November 5th.

THE SCIENCE OF MENTATION.

EDITOR OF SCIENCE: Some time since a reference was made in SCIENCE to a paper published with the above title in the *Monist* for July. The author was reported to have studied by experimental methods the development of certain forms of 'mentation' in dogs. As I have been greatly interested in the subject of comparative psychology for years, and have myself been devoting much time to the study of the psychic development of animals from birth onward with investigation of the contemporaneous changes of a physical kind especially in the brain, I looked up the article referred to, written by Mr. Elmer Gates. Many of the statements and conclusions are of so remarkable a character that I should be glad to get further information, as would, no doubt, others also. We are told that seven shepherd puppies were confined in a completely darkened room for nine months; that the mother was permitted to go in and out; but we are not informed as to whether the mother was admitted for the sole purpose of suckling the puppies, though this is the natural inference. Now, if a dam is capable of supplying *seven* puppies at nine months of age with all the nourishment they require, as one specially interested in dogs and who has for years made a special study of these animals and bred them extensively, I should like to know the facts; for nothing of like kind is, so far as I am aware, on record, and on the face of it I should doubt the possibility of such a thing. I see no necessity for any such drain on the dam, yet Mr. Gates' paper leaves the matter in doubt.

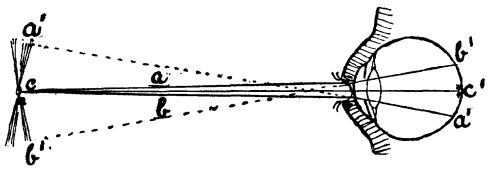
Again, though the most sweeping conclusions are drawn as to results both positive and negative following functional use and disuse, of certain portions of the organism, and though these experiments stand almost or quite alone, but meagre details are given either of the experiments or the anatomical appearances, and not a single illustration either diagrammatic or other accompanies the paper, nor is there any intimation that such details or illustrations have been or are to be published elsewhere. I should like to point out that such work is of but little use to scientific men in its present form, for at best it is only suggestive, not demonstrative. It is to be hoped that if Mr. Elmer Gates can furnish the details and illustrations necessary to meet scientific requirements he will lose no time in doing so, as, if his experiments, etc., are reliable and his conclusions correct, they are not only of great scientific interest but of much practical importance to educationists and others. Mr. Gates' paper abounds in very stimulating 'mentation,' and much of it seems to fit very naturally into my own mental moulds. In asking for more details I think that I am writing in the interests of a large class of scientists and others.

WESLEY MILLS.

PHYSIOLOGICAL LABORATORY,
McGILL UNIVERSITY, MONTREAL.

INVERTED IMAGE ONCE MORE.

IF Prof. Woodworth (see SCIENCE, October 25, p. 555) will look into my little volume on *Sight*, pp. 87 and 88, he will find described and explained not only the phenomena he refers to, but all his experiments with the lids. I have been familiar with the phenomena all my life, but first described and explained it in 1871 (see Phil. Mag., Vol. LXI., p. 266, 1871). I afterwards discovered that it had been previously explained by Priestley. It is not due to imperfect accommodation, as Prof. Cattell thinks, but to *refraction by the concave watery meniscus between the two lids and the surface of the cornea.* The following figure will explain itself and the phenomena in question. The central ray $c\,c^1$



from a candle passes straight to the retina as usual and forms the image on the central spot of the retina, but the upper marginal rays a are refracted upward to b^1 on the retina and the lower marginal rays b to a^1. These are referred back by the law of direction as shown by the dotted lines.

JOSEPH LE CONTE.

BERKELEY, October 30th, 1895.

Professor Le Conte describes one of the imperfections in the dioptric apparatus which lead to the formation of entoptic rays of light. In my note to which he refers I only noticed the inversion of the image, and did not attempt to describe the various defects which cause the dispersion of light, only saying, in agreement with Professor Le Conte, that "the light from a gas jet passing through the lower half of the pupil is in part refracted downward, affects the lower half of the retina, and is projected as rays extending upward." Professor Le Conte's explanation accounts for the vertical dispersal of light when the eyelids are partly closed, but there are other defects in accommodation which lead us to represent a 'star' not by · but by * .

I almost hesitate to refer again to the inverted image on the retina. The phenomenon is explained so clearly by Berkeley in his *New Theory of Vision* that it ought not to have been regarded as a puzzle since 1709. What Professor Le Conte has written on the subject in his suggestive and valuable book on *Sight* and recently in this JOURNAL (p. 629 of this volume) seems to me beside the mark. Our notions of up and down come from sensations of touch and movement. A visual image can only be erect or inverted in reference to other visual images—not in reference to entirely disparate sensations of touch and movement. The image of a man on the retina has the feet towards the image of the ground, and this is what we mean by being erect. The retinal image is in any case only a link in a chain of physical processes. We do not know how the nerve fibres from the retina are distributed in the brain, but it is highly improbable that they end in a surface or reconstruct in any way a picture or a model of of the external world.

J. MCKEEN CATTELL.

SCIENTIFIC LITERATURE.

British Association for the Advancement of Science (Ipswich, 1895). Tenth Report on the Northwestern Tribes of Canada. Fifth Report on the Indians of British Columbia. By FRANZ BOAS. 71 pp. 8vo.

This final report of Dr. Boas concludes the investigations, initiated in 1884, which have added so much to our knowledge of the social condition, mental and physical characteristics, languages and institutions of the northwestern tribes of the Dominion of Canada. The main portion of the report is concerned with an account, excellent in detail of presentation, of the 'Physical Characteristies of the Tribes of the North Pacific coast (pages 3–30, besides 11 tables of anthropometric data, and many lesser tables in the text)', we have besides notes on the Tinneh tribe of Portland Canal, the Tinneh tribe of Nicola Valley, the Nass River, and brief accounts of the Nîskâ (closely related to Tsimshian), and the Ts' E ts' ā út (a Tinneh dialect).

The value and extent of Dr. Boas' contributions to the physical anthropology of the Indians of the northwest coast may be estimated from the fact that the eleven tables alone contain the individual measurement (12 in each case) of some 500 Indians belonging to about a dozen tribes, or subtribes, and to several distinct linguistic stocks. The author's chief conclusions as to physical characteristics are as follows:

1. There is a gradual decrease in stature as we go southward along the coast from Alaska to Frazer River—the Tlingit averaging 173 cm., the Indians on the shore of Harrison Lake only 158 cm. As we go southward the stature increases again, but its distribution becomes very irregular. Somewhere between Vancouver Island and the Skeena River a very material change of type takes place. Dr. Boas shows