



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'* on the retina and the lower marginal rays *b* to *a'*. 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 \cdot 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 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 Characteristics 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 Niská (closely related to Tsimshian), and the Ts' Ets' á 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

clearly the uniformity of the Kwakiutl group of tribes, and incidentally notes that it is clearly shown that "a strong deformation of the kind practiced by the Kwakiutl increases the length of head and diminishes the breadth of head; but moderate degrees of deformation do not influence materially the lower portion of the skull in which the greatest width of the head is found." The dimensions of the face seem uninfluenced also.

2. This distribution of stature Dr. Boas considers as being incapable of being explained by difference of food supply or mode of life, but is due to 'a slow permeation of the tall tribes of the North and of the short tribes of Fraser River.'

3. From the study of the British Columbian tribes, as well as from his general survey of the Indians of the whole of North America, the author finds that the "proportionate difference between the stature of men and women is the less the smaller the people," and that "the women of the short tribes of the Pacific coast seem to be taller than those of the short tribes of other regions."

4. Four types must be distinguished on the coast of British Columbia: (1) Nass River Indian type; (2) Kwakiutl type; (3) type of Harrison Lake and Salish of the interior; (4) type of the Okanagan, Flathead and Shuswap. The Nass River Indians have a face "the breadth of which (156.5) may be called enormous, as it exceeds the average breadth of face of the North American Indian by 6 mm." The face of the Kwakiutl is marked by its enormous height; while the nose is characteristic. The Harrison Lake Indians have "a head exceedingly short and broad, surpassing in this respect all other forms known to exist in North America." The head of the Shuswap is "shorter than that of the tribes of northern British Columbia, or of the Indians of the Plains." Dr. Boas justly remarks the difficulty in comparing descriptive features, "on account of the large personal equation of the observers, and even of the same observer at different times."

5. Among the tribes, of Fraser River "children seem to be much more brachycephalic than adults." The author remarks, however: "Investigations carried on by means of exten-

sive material do not show any such differences, and it is likely that more extended investigations would cause the apparent difference to disappear; but it is also possible that in this region we may find the length of head to increase more rapidly than the breadth of head. Among the Eastern Indians, and in different parts of Europe, we find a slight decrease of the cephalic index with increasing age, but in no case does the difference exceed one per cent. We also find that the heads of women are somewhat shorter than those of men."

6. "The cephalic index decreases rapidly as we go up Fraser River, but is higher among the Shuswap than among the Nkamtcinemuq. The facial index increases quite regularly from Harrison Lake to the Shuswap, but we must remember that the face of the Ntlakyāpamuq'ō'e is much smaller than that of the Shuswap and that of the lower divisions of the Ntlakyā'pamuq. The nasal index is so variable that we cannot draw any conclusions from its average values."

7. The Ntlakyā'pamuq'ō'e, while speaking one language, offer "an excellent example of the fact that linguistic and anatomical classifications do not follow the same lines"—being a people of mixed blood.

A very interesting section of the report is that which deals with the average number of children per mother among certain of the British Columbian tribes—the Kwakiutl especially. Of the latter Dr. Boas says: "The maximum sterility is found among women who are now from forty to fifty years old, that is who became mature about twenty-five or thirty years ago. This agrees very closely with the time when the Kwakiutl sent their women most extensively to Victoria for purposes of prostitution. During the last decade a number of influential men among the tribe have set their influence against this practice, and we see at the same time a rapid increase in the number of children. The young women who have now an average number of 2.7 children, may hope to regain the number of children which their grandmothers had. But the only hope of preserving the life of the tribe lies in the most rigid suppression of these visits of women to Victoria, which are still continued to a considerable extent, and in an effort to stamp

out the diseases which have been caused by these visits."

Pages 30-34 are taken up with notes on the Tinneh tribe of Nicola Valley, now extinct, whose language Dr. Boas shows "was much more closely related to the Tinneh languages of British Columbia than to those farther south, although it would seem to have differed from the former also considerably." A noteworthy addition to our knowledge of British Columbian peoples is the sketch of the Ts'ets'á'ut, first scientifically studied by Dr. Boas (pp. 34-48) and of the Niská (pp. 49-62), details of whose sociology and folk-lore, etc., are given. The linguistics of the report (pp. 62-71), though not extensive, are new and valuable. Taken all together this excellent report fitly crowns the work of the committee under whose auspices these investigations were inaugurated. It is sincerely to be hoped that some way will be found to continue researches that have been productive of such great results and added so much to American anthropology and linguistics.

ALEX. F. CHAMBERLAIN.

Solution and Electrolysis. By W. C. D. WET-
HAM, M. A. Macmillan & Co., London and
New York. Price \$1.90.

This book forms one of the physical series of the Cambridge Natural Science Manuals. It gives a summary of the work which has been done up to the present time, but particularly during the last twenty years, on the physical properties of solutions. This subject forms a branch of physical chemistry which has, within the last few years, attracted towards it a number of eminent investigators, who have obtained results of great interest and importance. To the student of the properties of matter it is difficult to conceive of any more fascinating branch of study than that of diffusion, osmotic pressure, the influence of dissolved substances on the freezing point, boiling point and vapor pressure of solvents, and the very curious difference between electrolytic and non-electrolytic solutions. The subject is only beginning to crystallize and few systematic treatises, and these mostly German, are devoted to it. The present work will therefore be welcomed by readers who prefer works written in the English language. It gives

in brief form an account of the results so far arrived at and the theories towards which they point. This summary will no doubt prove of great service to students and also to physicists and chemists who have not followed the investigations in the publications of scientific societies and the journals.

The treatment of the subject is perhaps rather too brief, but outside of that the presentation of the subject is good and the printing is, as usual, very satisfactory. A few instances of somewhat careless statement exist as, for instance, the statement of the thermodynamic cycle on p. 26, which is incomplete. This is unfortunate, because everything with regard to the second law of thermodynamics seems to be a source of difficulty to students. Again, the references are occasionally misleading. Take, for example, that to Jahn's work on the Peltier effect given on p. 117. Most students would interpret it to mean that the idea of testing contact difference of potential through Peltier's effect originated with Jahn, whereas it has been in the minds of physicists and has given rise to discussion for forty years or more.

The paragraph on p. 204 on the explanation of the possible effect of specific inductive capacity on ionization power seems unsatisfactory. To any one who requires an explanation that given is probably useless.

Fitzpatrick's tables on the 'electro-chemical properties of solutions,' originally printed in the British Association proceedings, are given in an appendix and will no doubt be welcomed by many.

The book is well worth perusal and is a valuable addition to our works on physics and chemistry.

THOMAS GRAY.

Critical Periods in the History of the Earth. By JOSEPH LE CONTE. Bulletin Dept. Geology, University of California. Vol. I., No. 11, pp. 313-336. Berkeley, August, 1895. (Reprinted.)

This is, in a somewhat condensed form, the address which opened the discussion, by the Congress of Geologists at Chicago, August, 1893, on the question "Are there any natural divisions of the geological record which are of world-wide extent?" The author begins with a brief refer-