drinking; but what I must again object to is drawing radically different conclusions as to the nature of eating and drinking by chicks, and even building theories of evolution on them.

As I understand Prof. Cope is to reply to Prof. Baldwin's views on Consciousness and Evolution through the medium of the *American Naturalist*, I will only remark regarding his discussion in SCIENCE, p. 438, on Heredity and Instinct, that, while I find his views very interesting as illustrations of natural selection, the Lamarckian principle, the influence of environment, etc., they seem, in the main, to fall within the range of principles already recognized by the Darwinians and Lamarckians, though perhaps not adequately. But I fail to see that a single safe step can be taken in explaining evolution either in biology or psychology, if the effects of the environment and of use be ignored; indeed, Prof. Baldwin's very facts and illustrations are, to my mind, only comprehensible by the introduction of those factors; and why there should be such anxiety on the part of many to get rid of factors so obvious, and to substitute for them the biological fatalism and reasoning in a circle of Weismann, is a puzzle to me.

I trust Prof. Baldwin will not insist on coining many new terms, or favor their adoption as far as evolution is concerned. 'Social heredity' is about equivalent, is it not, to social environment, and the entire environment is one into which, as a rule, the animal is born, so why speak of 'social heredity?' Technicalities have their advantages, but they often conduce to mental myopia, and hamper the comprehension and progress of truth by binding it up in packages, so to speak—packages which all cannot readily undo.

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FOOTGEAR.

EDITOR OF SCIENCE: Apropos of the heel quarters or heel bands on the feet of men shown on Mexican and Maya sculpture and pottery Dr. Fewkes calls my attention to the fact that among the Tusayan Indians an embroidered heel band is worn over the moccasins in all dances. In the statuary shown by Maudslay and other authors the footgear looks as though a man were wearing a gaiter from which the vamp or front had been cut away. In this view the supposed sole is the pedestal; what appears to be a stocking is the moccasin, and the heel quarter is the decorated ceremonial heel band fastened across the instep with lacings.

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SCIENTIFIC LITERATURE.

Greenland Icefields and Life in the North Atlantic, with a New Discussion of the Causes of the Ice Age. By G. FREDERICK WRIGHT, D. D., LL. D., F. G. S. A., author of the *Ice Age in North America*, etc., and WARREN UPHAM, A. M., F. G. S. A., late of the Geological Surveys of New Hampshire, Minnesota and the United States. With numerous maps and illustrations. New York, D. Appleton & Co. 1896. 12mo. pp. xv+407.

The immediate impulse to the preparation of this volume arose in connection with a trip to Greenland taken on the unfortunate steamer Miranda in 1894. It will be remembered that this steamship of eleven hundred tons' burden started out with the intention of reaching Peary's headquarters in Inglefield gulf, with a complement of fifty-one passengers. Ten days out she collided with an iceberg off Labrador and returned to St. Johns for repairs. After reaching Sukkertoppen, the largest Eskimo settlement in Greenland, the steamer ran upon a reef and received serious injuries, compelling her to stop again for repairs and to start homeward as soon as possible. In less than two days' time she foundered, and the passengers and crew were safely transferred to the schooner Rigel. The senior author had an excellent opportunity to study icebergs in their legitimate work of producing geological changes, and had nearly a fortnight's time to explore the edge of the ice sheet close to the Arctic circle.

The authors have improved their opportunities by giving in this book an interesting resumé of what is known respecting the glaciers, ice fields, explorations, icebergs in action, the plants, animals, the Eskimo and the early Norsemen of Greenland. Mr. Upham prepared the chapters upon the plants, animals, explorations, and the lessons taught by the Greenland phenomena in the elucidation of the Ice Age. Besides the text several excellent maps of

Greenland, Labrador and the whole northern regions were drawn by him; and he has restated his views respecting the causes of the cold.

Greenland has an area of 680,000 square miles, of which 575,000 are occupied by the ice sheet. On the east side the coast consists very largely of ice cliffs, while on the west there is a border of habitable land towards twenty miles in width for more than half its length, and numerous glaciers cross this belt, reaching the sea and discharging icebergs therein. The edge of the ice is usually from 1,500 to 2,000 feet above the sea, quite precipitous; and thence the ice surface gradually rises to the altitude of 8,000 to 9,000 feet on the watershed, the whole surface being inclined westerly, at first six and later two degrees, till the summit is reached and the slope becomes easterly. Hayes called the interior 'a vast frozen Sahara immeasurable to the human eye.' Near the boundary, because of the greater ablation, the surface is crevassed and rivers flow freely, occasionally plunging into the abysses. The great central region is the analogue of the *névé* fields or gathering ground of the ice.

Areas of considerable altitude uncovered by ice or snow and hence bare rock or earth capable of sustaining vegetation like the Alpine garden of the *Mer de Glace*, in Switzerland, are called *nunatakr* (singular *nunatak*) by the natives. This word supplies a needed place in our vocabulary, and is being extensively used by glacialists.

The most important inland expeditions were those of Dr. Hayes, in Lat. 78°, 1860; Nordenskiold, in 1881, Lat. 68°; Nansen, 1888, in Lat. 64°, and of Peary, 1892, Lat. 78° to 82°. The last two only went entirely across the island. Nansen found that the kryokonite, described by Nordenskiold, as cosmic dust was rather to be regarded as material blown by the winds from the coast. Peary's trip was of the most consequence, as it was the farthest north and practically two routes, as the return road lay a hundred miles nearer the pole.

The notices of processions of icebergs and flows help to the understanding of the effects produced by floating ice, which are liable to be depreciated in these days when the glacier is invoked as the great agent at work. The bergs off the Labrador coast constitute a stream one hundred miles wide and one thousand miles long, derived chiefly from the north part of Greenland. Numerous seals accompany them, finding the conditions favorable for procuring food and for rearing their young. Their number is given as hundreds of thousands. In their train follow the Arctic bear, fox and innumerable flocks of birds, all dependent ultimately upon the food which the seals secure from the sea. Their worst enemy is man, and as the number of hunters has increased, with weapons terribly destructive, the products are diminishing in amount, so that the late financial collapse of Newfoundland is partially due to the poor success of the sealers.

A more important stream of floating ice is that which starts in the frozen seas north of Siberia, passes by the pole, skirts the east coast of Greenland and partially turns to the northwest at Cape Farewell. This procession commences late in January, as seen in southern Greenland, and continues into September. Intermingled with the ice are pieces of floodwood, which furnish the Greenlanders with lumber and firewood. Sometimes logs sixty feet in length are drifted upon the shore. Rink conjectures that the annual gleanings upon the whole coast may amount to from eighty to one hundred and twenty cords, a small part of which passes 68° N. Lat. This wood seems to have grown upon the banks of rivers in Siberia, being coniferous, and thus is unlike that drifted to the shores of northern Europe by the Gulf Stream. Freshets carry the logs far out into the Arctic sea, where they are drawn into a slow but steady current, which first sets to the northward from the northern coast of Asia and from Spitzbergen, and then passing on southwards conducts the ice floes of that region along the eastern coast of Greenland. It is to this current that Nansen has committed himself, confidently expecting to be carried past the north pole. Mr. Upham's map shows very clearly this projected route from Bennett's island or from the gulf of the Ob across to Greenland.

The story is well told of the Tertiary warm temperate plants of Greenland, so allied to the similar remains found upon both continents as to necessitate the belief of an early land connection between Europe and America. The

present flora, enumerated at 386 species by Lange, contains a slightly larger number of European than American species. Warming finds two botanical regions, of which the southern is characterized by the presence of the white birch, extending two degrees north from Cape Farewell, and contains many European types. The larger, or northern, region is more American in its facies, but the majority of the plants are circumpolar. Most authors have regarded this flora as of Scandinavian origin; but the suggestion is here made of the possibility of its being merely the wreck of the earlier Tertiary development. The Greenland flora is essentially that of the highest White Mountain summits.

All these and other details concerning the physical features of Greenland help us to imagine the condition of things over our northern regions in the ice age. Greenland must have had a greater development of ice in former times, since the present habitable strip of land is glaciated; but the authors believe it was milder there in the times of the early Norse settlements several hundred years ago. The débris in Greenland is principally transported in the lower part of the glaciers, whence it is possible to believe in a similar movement for the material of the drumlins and many boulders. The Greenland ice moves more rapidly than the Alaskan and Alpine glaciers, averaging about fifty feet daily. This may be due partly to the steeper slopes, which are from 100 to 200 feet per mile. Inclinations of fifty feet to the mile are necessary for vigorous movement; but a large part of the American ice did not possess surface slopes of more than twenty-five or thirty feet to the mile.

Attention is paid to the great elevatory movements of our continent upon both the Atlantic and Pacific coast, as well as on the Gulf of Mexice, which took place in pre-glacial times—from 2,000 to 3,000 feet in amount—and it is thought this uplift has been sufficient to develop the severe glacial climate. The astronomical theories, including the latest views of Croll, Wallace, Drayson, Becker, Sir Robert Ball and Sir John Evans, are weighed in the balance and found wanting in the comparison. The great uplift would have given rise to a high plateau climate with abundant snowfall and accumulation of an ice sheet, whose weight seems to have been a chief cause of the ensuing depression in the Champlain age.

The distribution of the till, more or less coincident with terminal moraines, allows of a classification into stages.

First came the culmination of the Lafayette uplift, which is regarded as Quaternary and therefore not to be esteemed as the equivalent of the Scanian or Norfolkian of Geikie, as they belong to the Pliocene. It includes the Albertan and Saskatchewan stages of G. M. Dawson. Next came the Kansan, Aftonian and Iowan stages, all of the four named being classified as the *Glacial* epoch proper. The second epoch is named the *Champlain*, being the time of melting and of subsidence, and is divided into the Champlain marine beds, the Wisconsin drift sheet indicating moderate reëlevation, the Warren glacial lake, the Toronto stage of temperate climate, the Iroquois lake and the St. Lawrence lake, overflowing through the Champlain basin into the Hudson river. The number of stages agrees exactly with those specified by Geikie for Europe, provided the Lafayette consist of two. The authors rank themselves as advocates of the unity of the glacial epoch. It is probable that the present diverse schools of glacialists will tend hereafter to a greater convergence than divergence. C. H. Hitchcock.

Hansen's Studies in Fermentation. Practical Studies in Fermentation, being contributions to the Life History of Micro-organisms. By Emil Christian Hansen, Ph. D., Professor and Director of the Carlsberg Physiological Laboratory, Copenhagen. Translated by Alex. K. Miller, Ph. D., F. I. C., F. C. S., and Revised by the Author. E. & F. N. Spon, London and New York (12 Courtland St.), 1896. Pp. xiv+277. 8vo. Illustrations. Cloth.

The general features of Dr. Hansen's reform in the fermentative industries have long been known to every one who is interested in the scientific and practical features of applied mycology. They are known as new and important departures in regard to method and application, and as important factors in the evolution of