in connection with this phenomenon that the country experienced almost the only few days of warm weather of the summer, but while the water was decidedly warmer in the north-west than elsewhere, the air temperature was higher over England than over the south of Ireland, and still higher than in the north of Ireland.

RECENT EDUCATIONAL REPORTS.[1]

THE protracted discussions in the House of Commons, the numerous leading articles in the newspapers and the frequent public speeches of politicians, concerned with the subject of education, with which we have been provided during the past six months, are evidence enough that English people are at least beginning to be interested in the important question of the provision made by the State for the education of its citizens. But interest alone is not enough, it must be intelligent; and to ensure this it is important that the instructors of public opinion should themselves be well informed, both as to what is actually happening in the schools and colleges of our own country and as to the systems of education in other lands. For these and similar reasons, the special reports published from time to time by the Board of Education, under the editorship of Mr. Michael E. Sadler, the director of special inquiries, have a peculiar value just now; while the general reports of H.M. Inspectors serve admirably to remind Members of Parliament that despite the changes which may be necessary in our educational administration, good, thorough work is even now being accomplished in most of our State-aided schools, whether elementary or secondary.

The two volumes dealing with education in the United States of America are concerned more with general principles and tendencies than with specific details as to methods of instruction. Though this will detract from their value to practical teachers, it gives greater opportunities to insist upon the necessity for the possession by our legislators of proper, high ideals as to the function of education. As Mr. Sadler says in a paper he contributes to the second volume, "a national system of education which made money-getting its central aim would deserve all the contumely which history in a more enlightened future would be certain to heap upon it." American educators are showing the world that it is possible at the same time to develop the higher faculties, to have a due regard to the pleasures of cultivated leisure, to encourage "sweetness and light," and yet thoroughly to equip their young men with a knowledge of recent advances in pure and applied science, so that without difficulty they may take an honourable part in the production of those material comforts without which the most cultured would find it hard to live.

Two factors, among many others, preeminently contribute to the success of American education. In the first place, there is the munificence of wealthy Americans. Mr. Percy Ashley, at the end of his article on American universities, tabulates the total amount of benefactions reported during the years 1890–1901. During these eleven years, very nearly twenty-three millions of pounds were given to higher educational institutions, not including libraries and museums, and more than two millions went to the Leland Stanford University alone. These princely sums are largely devoted to the encouragement of research; as Mr. Ashley says:—"In all the arrangements for research work the United States is much under German influence; and it is greatly to be regretted that England should be so far behind . . . In spite of the establishment in recent years of degrees avowedly for research by Oxford and Cambridge, there is still no place where organised research work is carried on in England . . . It must be said that the research work of the American universities is probably the part of their activity most worthy of study by those interested in academic progress in England. It must be admitted, however, that the material attractions to research and an academic career are far stronger in the United States than here."

[1] "Special Reports on Educational Subjects.' Vol. x. "Education in the United States of America." Part i. Pp. 538. Price 2s. 3d. Vol. xi. "Education in the United States of America." Part ii. Pp. 624. Price 2s. 6d. (Eyre and Spottiswoode.)

"General Reports of H.M. Inspectors on Elementary Schools and Training Colleges for the year 1901." Pp. 234. (Eyre and Spottiswoode.) Price 1s.

"General Reports of H.M. Inspectors on Science and Art Schools and Classes and Evening Schools." Pp. 98. (Eyre and Spottiswoode.) Price 5½d.

The second factor in the success of American education to which reference has been made is the recognition of the existence of a science, as well as an art, of education. Sir Joshua Fitch points out in his introductory paper that "America may be regarded as a laboratory in which educational experiments are being tried on a great scale, under conditions exceptionally favourable to the encouragement of inventiveness and fresh enthusiasm, and to the discovery of new methods and new truths." The experimenters are, moreover, well trained for their work. There is little scepticism as to the value of training for teachers in the minds of American authorities, and some idea of the pains taken to make the training as helpful and practical as possible can be obtained from Dr. Russell's account of the admirable Teacher's College of Columbia University, included in Part i. of the report. Among the numerous proofs, contained in these pages, of the success attained by the teachers proceeding from American training colleges, President Hadley's opinion may be quoted:—"Our best American schools of technology are no longer places for shop work, but places for the training of thinkers—of men who may not know how to do the particular things which will first be wanted of them, but who are in possession of that general knowledge which will enable them to learn more thoroughly the real bearings of any new problem as it arises. They have become less technical and more scientific."

The space available allows only the briefest reference to the general reports of H.M. Inspectors. Attention must, however, be called to the remarks of Mr. Pullinger, Chief Inspector of science and art schools in the northern division of England, on the work of evening continuation schools. He finds that many of the pupils in these schools "come for warmth, for the comforts of an attractive, well-lighted room, for the monthly lantern lectures and for the free trip to Blackpool at the end of the session." The schools have been variously described as "gather-'em-in-at-any-price-schools" and as "a sort of shelter for homeless boys and girls." Mr. Pullinger wishes "to state emphatically that the supply of really educational night schools is most inadequate." When it is remembered that the evening classes of our technical schools have largely to rely upon the preliminary training given to their students at these evening continuation schools, the immediate necessity for their improvement becomes evident, and it is to be hoped that the Board of Education will refuse its grants to all schools where the chief aim is recreative.

SNOW-WAVES AND SNOW-DRIFTS.[1]

THE primary object of a visit to Canada at the end of 1900 was to continue the investigation of terrestrial surface waves and wave-like surfaces, without, however, confining attention entirely to the study of such forms or motions of the snow as might be wave-like in character.

In Canada a geographical distribution of the kinds of snow was noticed. Near Montreal the snow was, on the whole, only moderately dry, and during December did not differ very much from what was seen in Scotland, on the Pentland Hills and near Grantown-on-Spey, during February, 1900, except that the freshly fallen flakes did not cling together to form mottling and rippling. The forms of the snow-drifts, or banks, in the neighbourhood of obstacles were not very dissimilar. The same general character of snow was observed as far west as Port Arthur, 1000 miles by rail from Montreal, the surface of the snow being generally soft. Near Winnipeg and westwards, at least as far as Medicine Hat, the appearance of the snow-banks accumulated in the neighbourhood of obstacles was strikingly different. Here the snow was almost perfectly dry and the snowfall light. The prairie was often swept quite bare of snow in the neighbourhood of the banks, and the surface of the snow on the prairie was generally hard and rough. But for its whiteness, the landscape resembled a desert with low isolated sand-hills more than a snow-scene in England. Much of this snow was granular, like sand, as the result of processes which it had undergone since its deposition.

On reaching the Rockies, the snow was seen to resemble more that of eastern Canada, but afterwards it became, apparently, still more moist, so that, in the next range, the

[1] Abridged from a paper by Dr. Vaughan Cornish, read before the Geographical Society on May 12 and published in the August number of the *Geographical Journal*.

Selkirks, perfect examples of the forms which gravity imparts to moist snow were met with.

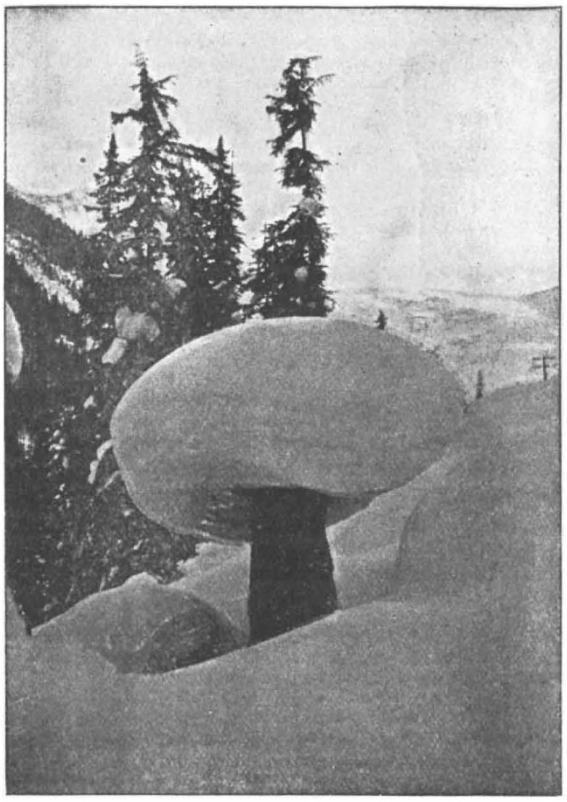

FIG. 1.—A Snow-mushroom nine feet in diameter.

At Glacier House a tree stump 2 feet in diameter had a cap of snow 9 feet across, the eaves projecting 3 feet 6 inches all round the pedestal. A broken tree with diameter of 4 feet had a snow-cap 12 feet across, the eaves projecting 4 feet beyond the pedestal (Fig. 1). Some of these snow-mushrooms must have weighed a ton.

That the "snow-mushroom" is, on the whole, so remarkably preserved from ruin by overloading may be attributed to bending of the strata under the action of gravity, their inclination to the horizon increasing with the distance from the pedestal.

Waves of drifting snow are only formed in dry snow at a low temperature. They are not so steep as the corresponding sand-waves.

Even when the surface is all covered with fresh snow, an extensive horizontal plain appears to be the best field for the growth of snow-waves, for the liability to local *surcharge* increases with the extent of the field of drifting. The more unlevel is the country, and the more numerous the places of shelter, the shorter is the time during which the wind can drift the snow in waves, and the smaller is the extension of the individual groups of waves.

Snow-fences are commonly erected in Canada to check the rate of snow-drifting. After the first snowfall, a snow bank or drift is produced, having a moderately gentle slope to windward and a cliff or cornice on the lee side. The form resembles that of a sand-dune or any other wave of a drifted powder, which at first suggests that the form proper to a drift caused by the fence is similar to that of freely drifting snow. This, however, is not the case, for the structure is as yet incomplete, owing to insufficient supply of the material. Succeeding snowfalls build out the drift with a diminishing cliff, until we have at last, perhaps not until nearly the end of winter, the completed form in which there is no lee cliff, but a long, gently tapering slope on the lee side, the weather face retaining its original form and *relatively* steep slope.

When we have to do with large bluffs or cliffs, the whole of the winter's snow is not sufficient to fill in the area of eddies on the sheltered side so as to reduce the surface to "easy lines." Thus the largest drifts are never of completed form, but have always a steep face to leeward. Completed drifts, having no shadow-throwing cliffs, are also much less conspicuous relatively to their size. Thus circumstances combine to prevent the casual observer from discovering what is the profile really proper to a snow-drift.

From an examination of the snow-drifts in Canada, the conclusion was reached that a curve of the character shown in Fig.

FIG. 2.—The fundamental Curve of Snow-drifts.

2, with the blunt end towards the wind, was the fundamental element of their form.

This, which may be termed the *ichthyoid curve*, is the profile of *completed* drifts in the neighbourhood of obstructions on the prairie.

Inverted, it is the profile of the holes round trees, as observed in the woods near Montreal.

Viewed in plan, it is the curve cut out in the snow round the end of a wall.

Viewed in plan together with its image, it is a boundary curve enclosing the horseshoe-shaped banks round houses near Winnipeg, and equally the hollows round trees or stones.

This doubled curve has the generalised form of a fish,[1] or if it be spun round so as to give the outline of a solid body, we have the modern Whitehead torpedo with the blunter head now preferred to the older sharp-nosed form.

The analogy to the fish-form is still more striking if fishes are looked at from above instead of viewing them in profile.

FIG. 3.—Stratification of Snow revealed by Wind Erosion.

The completed snow-drift in the neighbourhood of an obstruc-

1 The profile of the snow-drift resembles the profile of a sole or other flat fish.

tion may be regarded as a filling in of the eddy-space in such a way as to provide easy lines for the flow of the wind.

In waves into which freely drifting powders fall, the steep side is on the leeward instead of upon the windward, and this signifies that the eddy-space is *never* filled up. The whole eddy-space is, in fact, free to move forward, and does so when the snow is drifting, and this progression is the wave motion.

The relation between the profile of the snow-drift and that of the waves of drifting snow and sand may be further illustrated by drawing the profile of the wave, not in the usual way, from trough to trough, but from crest to crest. It is then seen that the unfilled space between the two ridges has the blunt nose and fine tail profile; that it is the profile of the hollows in snow round trees and of the fuljes of sandy deserts, tbe form proper to an eddy space.

The powder, when drifting in waves, has the "fine nose and blunt tail form," which is that of greater eddy-making resistance (the nose being that part turned towards the wind), and the powder, when in its complete accumulation near fixed obstructions, assumes the "blunt nose and fine tail" form, which is that of less eddy-making resistance. Both forms are simultaneously produced on a snow-field, and both are compatible with the removal by the wind of the maximum quantity of snow in the course of the winter. Thus, on the one hand, the maintenance of strong eddies in the drifting waves evidently increases the power of the wind to drive the snow before it; and the hindrance offered by a fixed obstruction is best minimised by filling in its eddy-space with a structure which shall thereafter absorb as little energy from the wind as possible.

Sometimes the freely drifting snow is accumulated in isolated hillocks, which have been called barchans or medaños. Sometimes their development from patches of drift snow can be observed. These patches have in ground plan a fine nose towards the wind and a blunt tail or lee end—a sort of delta shape, but with curved sides. The same thing may be seen in sand. This is in accordance with the habit of the freely drifting snow to adopt a fine nose and blunt tail arrangement in vertical profile.

Freely moving barchans of less or greater elongation probably fill in less or more of the narrow end of the ichthyoid curve. The crest of the cliff will be lower than the summit of the barchan if the former be beyond the broadest part of the curve. The erosion forms produced by wind when acting upon consolidated snow were also studied. Fig. 3 shows how the minute stratification of the snow is revealed by the action of the wind.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

THE following list of candidates successful in this year's competition for the Whitworth scholarships and exhibitions has been issued by the Board of Education, South Kensington:—Scholarships, 125*l.* a year each (tenable for three years):—William M. Selvey, London; Leonard Bairstow, Halifax; Isaac V. Robinson, West Hartlepool; Arthur Baker, Gosport, Hants. Exhibitions, 50*l.* (tenable for one year):—Charles Cook, Landport, Portsmouth; John S. Mitchell, Uddingston, near Glasgow; Charles J. Stewart, Fratton, Portsmouth; Arnold H. Gibson, Sowerby Bridge, Manchester; William E. W. Millington, Hollinwood, Oldham; Neil J. Maclean, Kelvinside, Glasgow; Henry J. Jones, Southsea; Harold Rawstron, Oldham; George H. Childs, Portsmouth; Norman L. Ablett, London; William E. F. Curror, Ilford, Essex; Walter L. Port, Brighton; John Alexander, Glasgow; Louis D. Stansfeld, London; Robert J. A. Pearson, Sheffield; William L. Perry, Plymouth; Arthur S. Angwin, London; Francis G. Steed, Devonport; Henry A. Bagg, London; Frederick J. Crabbe, Southsea; Arthur Garrard, Forest Gate, E.; Benjamin J. Thomas, Devonport; Maurice B. Dalby, Gateshead; Thomas Wadhams, Wolverton; Oliver S. Spokes, Crewe; James Crone, Charlton, Kent; Alexander B. Sowter, Glasgow; Fred Sykes, Huddersfield; Frederick E. Rebbeck, Belfast; Frank W. Harris, Swindon.

THE metropolitan and most of the provincial medical schools will be opened at the beginning of October. Among the addresses to be delivered, the following are announced:—*Charing Cross Hospital.* The fourth biennial Huxley lecture on "Recent Advances in Science and their Bearing on Medicine and Surgery," by Prof. W. H. Welch, of the Johns Hopkins University, Baltimore. *St. George's Hospital.* Address by Dr. T. T. Whipham. *St. Mary's Hospital.* An address by Sir A. W. Rücker, F.R.S. *Middlesex Hospital.* Mr. Stephen Paget will give an address. *University College.* An address by Mr. Percy Flemming. *London (Royal Free Hospital) School of Medicine for Women.* Address by Mr. Charles Burt. *School of Pharmacy.* Address by Dr. W. Palmer Wynne, F.R.S. *Royal Veterinary College.* Address by Prof. Bottomley. *Yorkshire College, Leeds.* Address by Mr. A. W. Mayo Robson. *University College, Sheffield.* Address by Sir H. G. Howse. *Owens College, Manchester.* Address by Sir Dyce Duckworth. *University College of South Wales and Monmouthshire, Cardiff.* Address by Dr. Berry Hart.

A SUMMARY of the more important recommendations contained in the report of the Indian Universities Commission, which has now been published in India, is given in the *Pioneer Mail* of August 8. Among other points, it is recommended that in addition to holding examinations, all universities should be recognised as teaching universities, and that there should be no more than five faculties, viz. arts, science, law, medicine and engineering. One regulation is certainly a tribute to the power of memorising possessed by the oriental mind; it is prescribed that "text-books to be read should be so long as to exclude the possibility of all of them being committed to memory"; another lays it down that "students should not be required to pass in science before entering on the University course. Instruction should include practical experimental work, and in examinations for the B.Sc., the practical examinations should be passed independently of the written examinations, and should have a separate minimum of marks. . . . The degree of D.Sc. should require original research." The improvement of the equipment of medical colleges is urged, as well as the establishment of a diploma of sanitary science. The universities are not recommended to undertake instruction in engineering, but are advised to encourage agricultural and commercial studies. We agree with the concluding remark of the commissioners, that "it is better for India that a comparatively small number of young men should receive a sound and liberal education than that a large number should be passed through an inadequate course of instruction leading to a depreciated degree."

SCIENTIFIC SERIALS.

Bulletin of the American Mathematical Society, (2) vol. viii. No. 10 (July).—E. J. Wilczynski, account of the first meeting of the San Francisco section, with abstracts of the papers read.—Mary M. Newson, a translation of Hilbert's lecture on mathematical problems (delivered at the Paris Congress, 1900).

American Journal of Mathematics, vol. xxiv. No. 3 (July).—S. Kantor, types of linear complexes of elliptic curves in space of r dimensions.—R. E. Moritz, generalisation of the differentiation process.—H. D. Thompson, simple pairs of parallel W-surfaces.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, April 24.—"On Skin Currents. Part iii. The Human Skin." By Augustus D. Waller, M.D., F.R.S. (from the Physiological Laboratory of the University of London).

In freshly removed healthy skin, the normal current is always ingoing and the response to electrical excitation by the induction coil is always outgoing. This response, called by Dr. Waller the "blaze," is a sign of its vitality, is independent of the normal current and amounts to from 0·0100 to 0·0400 volt, if tested, within forty-eight hours after removal, by tetanising currents of alternating direction in both pairs of direction.

Moribund skin and skin from post-mortem room give small reactions of variable direction amounting to not more than ten-thousandths of a volt.

In all cases, the electrodes were carefully tested and the skin subsequently killed by boiling, tested and found to give negative results.