

which produces the ridge and furrow so well known as 'ripple-mark.' Fine dust or mud settles too slowly, coarse shingle too quickly, to lend themselves readily to this mode of distribution by waves. A Low is dredged out in sand when the breaker-line remains stationary for a time, as *e.g.* during tidal high water. During the ebb of spring tides, a lagoon is often left between the beach and a second stretch of sand. This lagoon marks the strip where the breakers act during the period of neap tides. At low water of spring tides, the belt of sand beyond the Low is a sort of beach, the seaward face of which is where the wash of the waves acts. Beyond it, during the continuance of the spring tides the breakers commence the formation of a second Low. When the tide is up and the sea is rough, there is an outer line of breakers on the bank, which is locally called the Ball.

The connection between tidal nodes and the accumulation of sandbanks is dealt with, and the analogies with sand dunes are pointed out.

With regard to the sandbanks which accumulate on the more sheltered side of headlands, a good example of which is the Shambles shoal, eastward of Portland Bill, it is pointed out that the materials (broken shells, &c.) which form the Shambles sandbank are not deposited in still water. The sand deposits

mann, claimed to have carried out a very large number of experiments in support of his assertion; and his results were, moreover, brought before the well-known German Association of Naturalists and Physicians at one of its yearly meetings. Coupled, as Dr. Landmann's conclusions were, with the recommendation that only lymph should be used for inoculation purposes which had been officially declared germ-free—or, at any rate, devoid of pathogenic bacteria—his announcement gave such an impetus to the anti-vaccination crusade, and occasioned so much public discussion, that the Prussian Ministry felt it their duty to appoint a Commission to inquire into the character of calf-lymph. Meanwhile independent experimental inquiries were also started by various investigators, and amongst these Dr. Neidhart was able to show that Landmann's assertion that the red inflammatory margin of the pustules so frequently noticeable was directly due to the action of the bacteria present in the vaccine was not correct, inasmuch as such symptoms were produced when lymph quite free from bacteria was employed, whilst they were often absent in cases where the lymph was proved to be teeming with bacteria. The hysterical excitement caused by the circulation of Landmann's sensational statements was, however, considerably abated by the publication of the masterly report drawn up by Frosch upon the very large number of most valuable experiments undertaken in a purely scientific, uncontroversial spirit by the Prussian Committee of inquiry above referred to.

This document completely refuted Landmann's statements, and showed that the alarming conclusions arrived at by him had no real foundation in fact. Frosch further indicates, as the result of careful experiment, the best methods and most suitable precautions to be adopted in the inoculation of calves and the collection and application of the lymph, pointing out in the latter connection that local irritation from vaccination may be greatly moderated by diluting the lymph with glycerine.

These reassuring results were again independently confirmed by Kirchner, of Hanover, who, in extensive examinations of calf-lymph, found on no single occasion any pathogenic bacteria.

In the current number of the *Zeitschrift für Hygiene* the question has been again brought to the fore by the publication of elaborate experimental researches on the bacterial character of calf-lymph by Dr. Dreyer, of the Hygienic Institute of the University of Giessen.

Careful quantitative determinations of the bacterial contents of calf-lymph showed that the initial number of microbes present may vary considerably, and that in the majority of cases it is very large indeed—on one occasion reaching as many as 17½ millions in one cubic centimetre. Within twenty-four hours, however, a great diminution takes place; but this decrease does not continue at the same rapid rate. Thus, to cite one instance: a sample contained on the first day of its collection over 2½ millions of bacteria per c.c.; after five days, 112,750; after eighteen days there were still, however, 111,765 present. Some forms persist over very long periods of time; Dreyer observed bacteria after a lapse of five months, whilst Kirchner found 550 in a cubic centimetre sample over a year old.

To determine the pathogenic character of lymph-bacteria, Dreyer inoculated, subcutaneously and intraperitoneally, both mice and guinea-pigs. Out of thirty-five mice thus treated only two succumbed, one to subcutaneous and the other to intraperitoneal inoculation; in none of the other animals was any reaction perceptible. As regards the guinea-pigs, in no single instance did any result follow the intraperitoneal inoculations, whilst in nearly every subcutaneous inoculation a small and insignificant abscess was observed to form at the point of inoculation.

Not satisfied with these experiments, Dr. Dreyer experi-

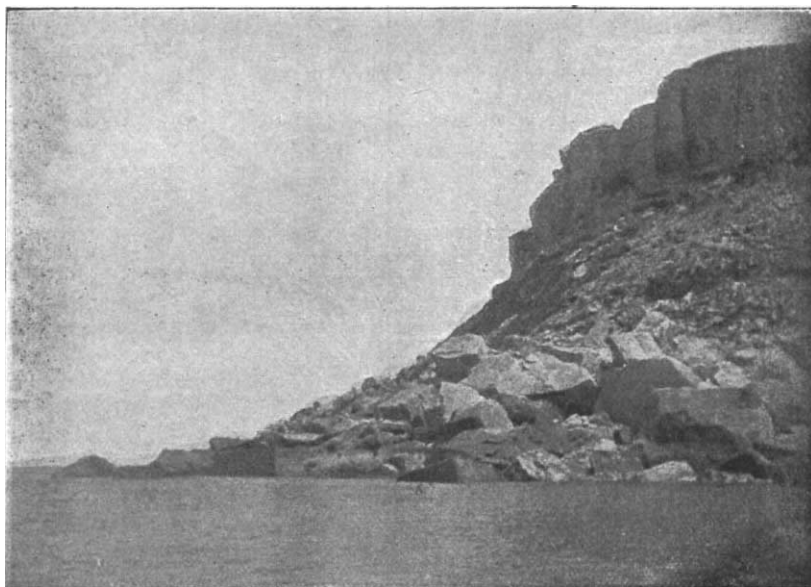


FIG. 2.—Blacknor Point, Portland.

from the mixing waters of meeting streams, an effect that is not surprising when we consider that the mixing of waters is achieved by vortices.

The checking and deflection of the streams is probably not nearly the whole of the mechanism by which the deposition of sand is brought about where a river meets the sea. A great part of this effect is probably due to the motions which attend the mixing of waters, a process which appears to be almost as potent a factor in the formation of sandbanks as is the mixing of airs in the production of clouds.

THE BACTERIAL CHARACTER OF CALF-LYMPH.

QUITE a flutter of excitement was produced in the ranks of the anti-vaccinators by the public announcement, made rather more than a couple of years ago, that lymph used for vaccination purposes frequently contained an immense number of bacteria, sometimes as many as two and one-half millions in a single cubic centimetre, and that amongst this vast microbial population forms were repeatedly present which, on inoculation, proved fatal to animals. A certain measure of authority was given to this communication, inasmuch as its author, Dr. Land-

'NO. 1489, VOL. 58]

mented upon himself and inoculated his arm each time with some of the same lymph he used for the mice and guinea-pigs respectively, but in no case did any reaction worthy of record follow.

In order to determine more particularly the qualitative bacterial character of these various samples of calf-lymph, plate-cultures were also made and pure cultures obtained of different bacteria, which were subsequently inoculated both into mice and into his own arm. In two cases coccus forms proved fatal to mice, whilst in the other inoculations no symptoms of importance followed. As regards the inoculations practised upon himself with these pure cultures, nothing more significant than a slight abscess resulted, except on one occasion when an affection of the adjoining lymphatic glands was experienced.

In commenting upon these results, Dr. Dreyer states that it should be borne in mind in connection with those instances where fatal results followed the introduction of the lymph into mice, that, in the first place, the mode of inoculation obliged to be adopted was not really comparable to the simple incision made in the case of human vaccination, and that, secondly, the quantity of lymph employed relative to the size of the animal was far greater than is the case in ordinary inoculations. Moreover, the two pathogenic results which followed the inoculation of a pure culture of a coccus form do not constitute any justifiable plea for the abolition of calf-lymph vaccination. It must be remembered that the conditions of such pathogenic infection are very different from those which may be present in ordinary inoculations, should pathogenic bacteria originally be present in the lymph, for, in employing a pure cultivation of a particular micro-organism, the latter is introduced into the system in immeasurably larger numbers than would be the case were it introduced direct with the lymph.

We would, in conclusion, recommend the closing paragraph of Dr. Dreyer's memoir to the consideration of that noisy section of unreasoning obstructionists who may, even in his experiments, endeavour to find some support for their crusade against the vaccination laws: "I consider, therefore, that I may conclude from my investigations that the latter afford no support which justifies the fear that animal lymph as at present prepared can produce any serious injury to those inoculated with it."

G. C. FRANKLAND.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—The Junior Scientific Club held its 188th meeting at the Museum on May 4. After the Treasurer's balance-sheets had been read and carried, Mr. A. E. Tutton discoursed on the Glaciers of the Pennine Alps, illustrating his remarks by numerous lantern slides. Mr. H. E. Stapleton (St. John's) read a paper on turpentine extraction in the Southern States.—The Officers for this term are: President, Mr. W. E. Moss (Trinity). Chem. Sec., Mr. F. Soddy (Merton). Biolog. Sec., Mr. E. Gurney (New Coll.). Editor, Mr. H. E. Stapleton (St. John's). Treasurer, Mr. W. E. Blackall (Non. Coll.). Committee, Mr. W. B. Billingham (St. John's), Mr. C. E. A. Wilson (Ch. Ch.), Mr. F. P. Nunneley (B. N. C.). The conversation will be held on May 24—Tuesday in Eight's Week—at 8 p.m.

CAMBRIDGE.—A University lectureship in applied mathematics will be vacant at the end of the academical year by the resignation of Mr. R. T. Glazebrook, F.R.S. Applications are to be sent to the Vice-Chancellor by May 17.

The Smith's prizes are awarded (1) to Mr. E. W. Barnes, Trinity, and (2) to Mr. W. A. Houston, St. John's.

Dr. Kanthack proposes to hold, during the Long Vacation, courses of instruction in general pathology, morbid anatomy and histology, bacteriology, and clinical pathology. The courses begin on July 8.

The University tables at Naples and Plymouth are about to be vacant. Applications for facilities for zoological research are to be sent to Prof. Newton by June 1.

Twenty-four candidates have passed the half-yearly examination in sanitary science just completed, and have received the University diploma in public health.

Twenty-eight additional freshmen, including one advanced student, were matriculated on May 5.

The University grant of 100*l.* a year for three years, made to

the British School of Archaeology at Athens in 1895, is to be renewed for another period of three years.

The Frank Smart studentship in botany, of the annual value of 100*l.* for two or three years, will be vacant on June 20. Candidates must be B.A.s who have taken honours in the Natural Sciences Tripos. Application is to be made to the Master of Caius College by June 11.

A combined examination for entrance scholarships and exhibitions in natural science will be held by Pembroke, Caius, King's, Jesus, Christ's, St. John's, and Emmanuel Colleges next term, beginning on November 1. A large number of major and minor scholarships and exhibitions, varying in annual value from 80*l.* to 30*l.*, will be offered. The subjects include chemistry, physics, elementary biology, physical geography, animal physiology, zoology, and botany; and candidates may offer from two to four of these. In all branches the candidates' practical work will be tested. Full particulars may be obtained from the Tutors of the respective colleges.

THE Duke of Devonshire stated in the House of Lords on Monday that, as soon as the Committee stage of the Irish Local Government Bill was disposed of, the London University Commission Bill would have a prominent place among those measures which the Government intended to pass during the remainder of the Session.

DURING the past fifteen months, says the Paris correspondent of the *Chemist and Druggist*, the sums subscribed by manufacturers and bankers in the district of Nancy for promoting the study of chemistry and physics, as applied to industry, in connection with the University of that town, have reached 400,000*fr.* (16,000*l.*). The Lyons University has been authorised to contract a loan of 626,500*fr.* (25,000*l.*), to be applied (1) to completing the Chemical Institute, (2) extending the laboratories of experimental and comparative medicine and physiology, (3) completing the laboratory of maritime physiology at Tamaris, Var.

THE following items concerning endowments of higher scientific education in the United States are recorded in *Science*:—The West Virginia University has established eleven fellowships yielding 300 dollars yearly and free tuition. The fellows are expected to teach one hour a week or give two hours' supervision in the laboratory. Among the eleven subjects for which the fellowships have been awarded are chemistry, physics, geology, zoology, botany, mathematics, mechanical engineering and civil engineering.—The estate of Mrs. Julia W. James, of Boston, divided by her will between the Museum of Fine Arts and the Massachusetts Institute of Technology, amounts to over 500,000 dollars.—The John Tyndall Fellowship of Columbia University for the encouragement of research in physics has been awarded to R. B. Owen, a graduate of the School of Engineering and professor of engineering in the University of Nebraska. Among the twenty-four fellowships annually awarded are the following: T. E. Hazen, botany; B. H. Owen, philosophy; J. D. Irving, geology; E. Kasner, mathematics; W. C. Kretz, astronomy; J. W. Miller, jun., mechanics; F. C. Paulmier, zoology; F. J. Pope, chemistry; C. E. Prevey, statistics; R. S. Woodworth, psychology.

SOCIETIES AND ACADEMIES.

LONDON.

Geological Society, April 20.—W. Whitaker, F.R.S., President, in the chair.—Note on an ebbing and flowing well at Newton Nottage (Glamorganshire), by H. G. Madan. This well lies in a direct line drawn north and south from the church of Newton Nottage to the sea, about 80 yards south of the church and 500 yards from the sea. Sand-hills about 20 or 30 feet high lie between it and the sea. A range of carboniferous limestone cliffs runs east and west to the north of the church, while the same formation crops out in the sea at half-tide level. Between the two there is a band of Keuper conglomerate covered in one place at least by 7 feet of brown loamy clay with pebbles. At the shore-junction of conglomerate and limestone numerous springs occur, and it is in the conglomerate that the well is sunk, its bottom being 8 feet above Ordnance datum. A series of about forty observations made at intervals of an hour (and in many cases at the intermediate half-hours), during three consecutive days, enabled the author to construct