

connection with those other cultures which failed of success. I am indebted to one of my students, Mr. Ronald Grant, for much help in the needful manipulations.

Union of the two cœlomic vesicles in front of the mouth took place about the twentieth day, while complete separation of the hydrocœle from the left posterior cœlom was accomplished by the thirtieth day, all the radial pouches being unmistakable before the end of the fifth week. Fixation was observed on the fifty-second day, but it appeared afterwards that one or two specimens must have attached themselves at least as early as the middle of the seventh week. Now, in the ninth week, my largest specimen measures 1.75 mm. across the disc, is provided with three or four pairs of sucker feet in each ray, has well-developed eye-spots, and can travel at the rate of an inch in five to seven minutes.

Various abnormal larvæ were observed, the most remarkable being three specimens with double hydrocœle. These were perfectly symmetrical externally, and also internally, except that the left hydrocœle alone was provided with a hydropore. One of them was unfortunately lost, the second was preserved early, while the third reached a length of more than 2 mm. and entered on the stage of attachment. It then presented a remarkable appearance—the two sets of hydrocœle buds appearing as outgrowths on the surface; the arm-lobes arching round the posterior end of the body in the sagittal plane; the hydropore in the mid-dorsal line; the long processes of the ciliated band in great part absorbed; the mouth and œsophagus still open and in functional activity; the internal cavities apparently quite similar on both sides; and the whole as symmetrical as the conventional *dipleurula*, to which indeed the mode of attachment by the preoral lobe and the slanting carriage of the body gave additional resemblance.

As I watched the specimen after it became attached, the brachia, and partly also the sucker, were being used with great activity, and in such a manner that, during the thirty minutes I had it under observation, it travelled four millimetres across the bottom of its dish. When next I had the chance of looking at it, the specimen was detached and somewhat contracted, and fearing that it had suffered injury in the previous manipulation, I preserved it for future work.

It is remarkable that the twenty-five brachiolarizæ available for examination provided me with three examples of double hydrocœle. The culture had been made early in the season, at a time when the ovaries were distinctly unripe. It is open to suggest that these facts are directly related to one another, abnormal potencies that are ancestral in their derivation being likely to be strongest in ova hurriedly matured. Under natural conditions, double hydrocœle is apparently so rare in feeding brachiolarizæ that it has hitherto escaped record, although, as is well known, MacBride has directed attention to noteworthy instances of its occurrence in *Asterina*, *Ophiotrix*, and *Echinus* (Q.J.M.S., vols. xxxviii., p. 368; li., p. 570; lvii., p. 235). J. F. GEMMILL.

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Clouds and Shadows.

MR. CYRIL CROSSLAND'S description (p. 322) of great shadow bands cast across the sky at sunset interested me, for I well remember being impressed by a similar phenomenon when crossing a New Mexican prairie, with the sun setting behind the Rockies. I have seen the bands in England, but imperfectly. To a non-expert, like myself, Mr. Crossland's remark, "The shadows being cast by the

reflected light of the glowing clouds in the west, not by the sun itself, of course," presents difficulties. A mass of glowing cloud seems too extensive a luminous source to cast definite shadows of peaks comparatively near it. Further, the sun being beyond the cloud, the bulk of the sunlight reflected by the cloud would fall the wrong way. Long after the sun's rays are cut off from the spectator, they will still be shining upon clouds high overhead, and therefore able to cast shadows.

If we suppose the shadow rays described to be cast by the sun itself, then it is easy to explain the appearance of the rays converging to the east, which puzzled Mr. Crossland. If the height, above the earth, of the under-surface of the cloudy stratus be roughly uniform, then this surface may be practically regarded as plane so far as it is visible to the spectator. At any rate, the curvature will be small, for the visible portion of the cloud canopy is a very small fraction of the sphere, concentric with the earth, of which it forms part. The sun being practically at infinite distance, the rays of shadow cast by it upon this overhead plane will be parallel, and hence, by the laws of perspective, will appear to converge as they recede from the zenith, or region nearest the spectator, to more distant regions east and west.

Perhaps it is not always realised how far clouds "on the horizon" may be beyond the (terrestrial) horizon. It is quite an interesting little exercise to work out. Assume the earth to be a smooth sphere, and the lower cloud surface a smooth concentric sphere. Let a line be drawn from A, the eye, to touch the earth at B, and produced to cut the cloud sphere at C. We have, roughly,

$$BC^2 = (4000 + h)^2 - 4000^2 \text{ miles,}$$

h being the height of the cloud above the earth. BC is independent of the spectator's altitude. For a cloud-height of five miles (if I have worked it right) BC is about 200 miles; and for a cloud-height of half a mile, BC is $89\frac{1}{2}$ miles.

The first volume of a great German work on meteorology was devoted to explaining why the popular impression of the form of the sky is that of a flattened vault. If this is the general impression, it has struck me that it may be based on observation of the local cloud canopy rather than of the clear sky.

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POLITICS AND SCIENCE.

WE desire to call attention to two lectures delivered by Professor Karl Pearson on March 12 and 19, and now published in pamphlet form (Dulau & Co., Ltd., 1s. each). The first is entitled "Tuberculosis, Heredity and Environment," the second, "Social Problems: Their Treatment, Past, Present and Future."

The first lecture contains an account of the recent work carried out at the Galton Laboratory for National Eugenics on the subject of tuberculosis, and it is deeply to be deplored that the evidence therein contained was not made public before the Insurance Act scheme for spending vast sums of money on sanatoria was formulated. It is not too much to say that Prof. Pearson's work must revolutionise our ideas on the subject.

Briefly stated the results go to show that, at present, the influence of infection in the actual spread of the disease is small. The infection is so wide-spread that practically all the urban popu-

lation are exposed to it, while only those with hereditary liability contract the disease in a severe form.

We should expect that infection would be very active between husbands and wives, and between them greatest in the poorest class, where the chances of isolation are least. Yet in that class there is no correlation of disease in husband and wife, and in the professional class the correlation only rises to 0.28—a value about equal to that for physical characters such as eye colour or stature, where it is clearly referable to selective mating. Thus between husbands and wives there is no clear evidence of infection at all.

Between parents and children, on the other hand, there is clear proof of correlation, while the fact that a tuberculous mother is only very slightly more dangerous to the child than a tuberculous father, and more dangerous only at very early stages of life, shows that the influence of infection, just appreciable in this case, is very small compared with that of heredity.

A study of the death-rates from phthisis shows that, while a fall has been going on since returns were available, that fall was greatest between 1866 and 1891, and has been less marked during the more recent years when the ways of the tubercle bacillus have been known, and the open air treatment become general.

The facts, of which we have given but a few examples, point to a gradual elimination of susceptible stocks by a process of racial selection as the chief cause of the diminished death-rate, and throw doubt on the efficacy of many of the remedies now confidently recommended.

Prof. Pearson's second lecture contains a powerful plea for organised knowledge as a guide to social and legislative action. It gives many horrifying if amusing examples of the mistakes which may follow a reliance on the recommendations of officials, politicians, or philanthropists, who bring to the consideration of social problems no knowledge of biology or modern statistical methods.

THE CULTIVATION OF COTTON.¹

THIS collection of papers and reports on the subject of cotton, prepared for the most part by writers directly connected with the cultivation of this staple, and in every instance by authorities on the subject, provides a succinct review of the efforts which are being made in the various cotton-growing countries of the world to improve the quality of the product by careful selection of seed, sound methods of cultivation, and increased efficiency in the control of insect pests and diseases due to fungi.

There are only two papers included in the collection. The first of these, by Mr. W. L. Balls, botanist to the Khedivial Agricultural Society,

Cairo, deals with the application of Mendelian principles in the breeding of cotton, and bears evidence of careful experiment and critical observation. The second, by Mr. G. C. Dudgeon, at one time inspector of agriculture for British West Africa, is a painstaking attempt to summarise our knowledge of the identity and distribution of the cottons in indigenous cultivation in the British West African colonies. These cottons the writer is able to deal with from personal inspection and with a knowledge obtained at first hand; his paper thus forms a useful supplement to the well-known work on the wild and cultivated cotton-plants of the world which we owe to Sir G. Watt.

From the reference point of view, however, the main value of the work resides in the series of reports dealing with the cultivation of cotton in the United States of America, including in this case also the Sandwich Islands and Porto Rico; in all the British colonies, dependencies, and protectorates; in the colonies of France, Germany, Portugal, Holland, and Belgium, and in a few foreign countries "from China to Peru."

That the reports are not all of equal importance need scarcely be said. Foremost in this respect, as in the position which it occupies in the collection, is the report supplied by the United States Department of Agriculture, the intrinsic value of which is enhanced by the provision of an exhaustive list of the publications bearing on this subject which have been issued by that active and well-organised department. The subject of cotton in India is exhaustively discussed by Mr. G. A. Gammie, cotton specialist to the Indian Agricultural Department. Important and full of interest is the corresponding report for the British West Indies forwarded by Dr. F. Watts, the Imperial Commissioner of Agriculture. Interesting and valuable also are the reports by Dr. O. Warburg on cotton in the German colonies; by Mr. W. L. Balls on cotton in Egypt; and by Mr. H. P. Taveira on cotton in the Portuguese colonies.

In alluding especially to these particular reports as perhaps the more important no reflection on the other reports which the volume includes is intended. As a matter of fact, the importance of a particular report depends rather on the area with which it deals than on the form in which it is presented. In this latter regard a high standard has been observed which reflects equal credit on the officers who have supplied the reports and on those responsible for editing them. If not all of equal importance, all the reports are of great value, and the volume in which they appear should prove a useful addition to the many standard works on the subject of cotton. One of the best features of the work is an excellent map of the cotton-growing areas of the world. With all its excellences, however, the work shows one lamentable defect: there is no good general index. The omission to provide this detracts considerably from the value of the collection as a ready work of reference.

¹ International Association of Tropical Agriculture and Colonial Development. "Papers and Reports on Cotton Cultivation." Presented to the International Congress of Tropical Agriculture, Brussels, May, 1910. Supplementary to the general "Report on the Present Position of Cotton Cultivation." By Dr. W. R. Dunstan, F.R.S. Pp. viii+320+map. (Paris: The Association, 34 Rue Hamelin; British Section—London: Imperial Institute, S.W., 1911.) Price 5s.