

main intact for weeks or months. No doubt in these cases also the entrance of the hyphæ or haustoria into the tissues is aided by any factors which cause the cell-walls to be softer or thinner than in the normal condition; and it is certain that many failures by those who have experimented with Uredinous fungi are attributable to their sowing the spores on older, well matured tissues.

We are here, however, abandoning the subject of the present lecture, because, in the first place, the phenomena just referred to appertain to sporadic rather than epidemic diseases, and because, secondly, they tend to the subject of *symbiosis* proper, where the relations between the host and the parasite have become so arranged that both may be said to benefit by the commensalism, as exemplified in the lichens, and some of the recently described cases of mutualism between fungi and the roots of Phanerogams.

*April 17, 1890.*

Sir G. GABRIEL STOKES, Bart., President, in the Chair.

The Presents received were laid on the table, and thanks ordered for them.

The following Papers were read:—

- I. "Preliminary Note on Supplementary Magnetic Surveys of Special Districts in the British Isles." By A. W. RÜCKER, M.A., F.R.S., and T. E. THORPE, Ph.D., B.Sc. (Vict.), F.R.S. Received March 5, 1890.

During the summer of 1889 we carried out additional magnetic surveys of the Western Isles and the West Coast of Scotland, and of a tract of country in Yorkshire and Lincolnshire.

Both districts were selected with special objects in view. We had found that powerful horizontal disturbing forces acted westwards from the Sound of Islay, from Iona, and from Tiree, and we had deduced a similar direction for the disturbing force at Glenmörven from Mr. Welsh's survey of Scotland in 1857-58. The whole district presents peculiar difficulties, partly from the fact that local disturbance is likely to mask the effects of the regional forces, partly because the normal values of the elements must be especially uncertain at stations on the edge of the area of our survey.

If, then, the general westward tendency of the horizontal disturb-

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ing forces was due to some source of error, stations in the extreme south of the Hebrides would in all probability be similarly affected. If the directions of the forces were due to a physical cause, such as a centre of attraction out at sea to the west of Tiree, then the disturbing forces in the Southern Hebrides would almost certainly be directed southwards towards it.

The observations made last summer prove (1) that the direction of the disturbing horizontal force at Bernera, which is the southernmost island of the Hebridean group, is due south; and (2) that, as this point is approached from the north, the downward vertical disturbing attraction on the north pole of the needle regularly increases, which exactly agrees with the supposition that a centre of attraction is being approached.

There is, therefore, now no doubt that there is a centre of attraction on the north pole of the needle to the south of the Hebrides and to the west of Tiree.

(3) In one of the maps communicated to the Society last year we drew two lines, bounding a district about 150 miles long and 40 miles broad, in Yorkshire and Lincolnshire, and gave reasons for the belief that a ridge line or locus of attraction lay between them.

This conclusion has now been tested by means of thirty-five additional stations, with the following results:—(1) At all stations (with one exception) on or near the two lines, the horizontal disturbing forces tend towards the centre of the district they bound.

(2) The downward vertical disturbing forces are greater in the centre of the district than at its boundaries. In particular, there are two well-marked regions of very high vertical force.

(3) The greatest vertical force disturbances occur at Market Weighton, where the older sedimentary rocks are known to approach the surface, and at Harrogate, which is on the apex of an anticlinal.

(4) The central ridge line runs from the Wash parallel to the line of the Wolds to Brigg. Thence it appears to turn west, and reaches Market Weighton *viâ* Butterwick and Howden. One or two additional stations are, however, required to determine whether this bend is real, or whether the line runs direct from Brigg to Market Weighton. From the latter town it passes to the limestone district of Yorkshire and traverses its centre. It has not yet been traced west of the line of the Midland Railway between Settle and Hawes, but there is ground for believing that it continues to the Lake District.

Although, therefore, one or two points of detail remain for further investigation, the existence of a line of attraction 150 miles long is proved beyond the possibility of doubt, and for about 90 miles its position is known to within 5 miles.

There are, then, even in those parts of England where the super-

ficial strata are not magnetic, regions of high vertical force comparable in size with small counties, and ridge lines or loci of attraction as long and almost as clearly defined as the rivers. Their course is closely connected with the geology of the districts through which they run.

## II. "The Variations occurring in certain Decapod Crustacea.—

I. *Crangon vulgaris*." By W. F. R. WELDON, M.A., Fellow of St. John's College, Cambridge, and Lecturer on Invertebrate Morphology in the University. Communicated by Professor M. FOSTER, Sec. R.S. Received March 20, 1890.

It is well known that two sets of animals, belonging to the same species, but living in different places, exhibit differences from one another by which they can, in many cases, be easily distinguished. But it is at the same time equally certain that the forces determining the differences between local races of the same species do not so act as to produce the same effect upon all individuals of the same race: for I am aware of no case in which the individuals composing any race of animals—however small and isolated the area in which they live, however uniform the conditions which obtain throughout that area—have been shown to resemble one another *exactly* in any character.

Since the adjustment of a local race to the average proper to it is not complete, the question arises, whether it is not possible to determine the degree of accuracy with which this adjustment is effected, and the law which governs the occurrence of deviations from the average. The object of this paper is to give an account of certain observations made at the laboratory of the Marine Biological Association at Plymouth, in order to determine, *first*, the average length of three or four organs which admitted of accurate measurement, and, *secondly*, the frequency with which the average length and every deviation from it occurred in one or two local races of *Crangon vulgaris*.

In making this investigation, I have had the great privilege of being constantly advised and helped, in every possible way, by Mr. Galton. My ignorance of statistical methods was so great that, without Mr. Galton's constant help, given by letter at the expenditure of a very great amount of time and trouble, this paper would never have been written. I am glad to take this opportunity of expressing my gratitude for his generous conduct. I have also to thank Dr. Donald MacAlister for explaining to me many points connected with the law of error, and for helping me in various ways.