the two hundred cells measured has undergone the full sequence of growth-ring deposition; otherwise there should be thin walls among the small-diameter hairs.

The form of the upper boundary, showing that a lumen the radius of which is about one-fifth of the cell radius is normally left unfilled, is of physical interest, as will be seen presently.

A result of technological importance, both to cotton-spinner and cotton-grower, relates to the question of 'nep'. These hairs (which have walls so thin that they easily roll up into tangled bundles during their passage through the machines) are seen in this diagram to be predominant in the cells of big diameter, and to be absent among small diameter cells. Formerly one had imagined that they would be found in all diameters.

Lastly, we would point out that care should be taken in translating such data as these, drawn from the dead dry hair, into terms of growth and development. We have found that the frequency diagram of cell diameter undergoes remarkable modifications according to the condition of the hairs when measured. Living hairs measured from the green boll are much larger than the dead hairs, and these again are much larger than hairs 'swollen' with caustic soda to restore them to cylindricality, in Harland's method.[5] But, whereas the shape of the frequency distribution is unchanged between the living hair and the soda-treated hairs, the case is quite otherwise with the dry dead hairs; these have a far more compact distribution, and we have verified by direct search through our material that the thick-walled small hairs actually enlarge their diameter when the irreversible loss of water takes place at death; their centre is in compression when alive, presumably through convergence of the space-lattice columns of the fibrils towards the centre. This inference is cross-checked by Slater's unpublished observation, that the core of a cylindrical hair is more rigid than its periphery. In the thin-walled hairs, the removal of the water lost irreversibly after death allows the periphery to contract; the outer growth-rings, primary wall, and cuticle are thus in a state of tension, which accounts for the fact that most cross-sections of the dead cell have a crumpled appearance, unless the wall is more than half a radius in thickness. On softening with caustic soda, this tension relieves itself and the diameter decreases still further, even in the thick-walled small hairs.

It is remarkable that the physical properties of the cellulose wall should result in presenting to the cotton-spinner a much more uniform product than is produced on the plant, even though the plant has already done its best for him by making hairs of fairly uniform weight out of cells the diameter of which varies greatly. Thus, in the present diagram, the range of cell diameter from 5 to 19 microns (μ) might be expected to entail a range of cross-sectional area from 25 to 361 (being the squares of these diameters), whereas the actual area range is only from 25 μ^2 to 220 μ^2.

C. H. BROWN.
ABD EL GHAFFAR SELIM.
W. LAWRENCE BALLS.

Ministry of Agriculture,
Botanical and Plant Breeding Section,
Gîza, Mar. 22.

[1] W. L. Balls, "Development and Properties of Raw Cotton", London, 1915, p. 143.
[2] W. L. Balls, "Growth Fluctuations during the Development of Seed Cotton", *Tech. Bull.*, No. 101. Min. of Agric., Egypt.
[3] W. L. Balls, "Studies of Quality in Cotton", London, 1928, p. 154. Also Iyengar, R. L. N., and Turner, A. J., "The Weight per Inch of Fibres of different Lengths", Indian Cent. Cott. Comm., *Tech. Bull*, B, No. 7.
[4] Pierce, F. T., "Mechanism of Growth in the Cotton Hair", *Trans. Faraday Soc.*, No. 115, 26, part 12, 1930.
[5] Calvert, M., and Harland, S. C., "An Approximation to the Original Cell Diameter", *Shirley Inst. Memoirs*, vol. 2, No. 29.

Plankton Changes on the Coast of Ecuador.

I HOPE some oceanographer will be prompted to write at length some explanation (1) of the erratic behaviour of El Niño and (2) of the lenses of foul yellow water of which Mr. G. Sheppard writes in NATURE of April 25. May I make two suggestions?

The coolness and fertility of the Humboldt water is due to the upwelling of water from the depths to replace surface water blown westward by the prevailing off-shore winds of Peru and Chile. In *Yachting* of March and April, I read that the sailing yacht *Carlsark*, in six weeks of a voyage across the Atlantic last year, in the trade wind belt had only one day of north-east trades—and that, the first day out of Santa Cruz. Might not the cause of El Niño overcoming the Humboldt be due to a similar failure of the south-east trades over the Andes?

Winter gales pile up sea-wrack in the salens of Scotland's west coast. Several such inlets have the appropriate place-name of Brennfort (stinking port). With an off-shore wind and a high spring tide, I have seen huge areas of this putrid weed carried out into the sound in summer time. May I suggest, though unfamiliar with local physiography, that the prevailing in-shore wind of the Bay of Panama chokes up lagoons with rotting sea-ware, and that, concurrently with high tides, a reversal of the usual wind, for example, by the north-east trades crossing the Isthmus, might carry out the stagnant water to join El Niño?

I fear this is not a sufficient cause for the vast volume of putrid water that created such havoc among fish and birds off the Peruvian coast some six years ago. I have heard that boats painted with white lead turned quite black. That extensive miasma might have been due to volcanic action in the seas round the Galápagos.

WILLIAM SEMPLE.

Mile Ash, Dumfries,
April 27.

MR. G. SHEPPARD's letter under this heading, in NATURE of April 25, directs attention to a matter which may be of serious importance. Apparently, the fœtid plankton accumulations described were dead material. Years ago, when oil began to be discharged upon the troubled waters of the oceans, some of us suggested *that the plankton might suffer*. Since then, multitudes of birds have been cast dead upon our shores enwrapped in oil. Occurring as these discoloured patches do, in the steamship lanes, they may be but a fulfilment of our prediction—one which sooner or later must come true: we cannot for ever sin against Nature. Has any attention been paid to such possibility by those who are studying the problem? Forced by modern sanitary practice to send our phosphates to sea, it will be strange if revenge be taken, through the oil wasters who are everywhere fouling the ways of life: through their interference with the recovery of phosphate by plankton.

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The Mode of Action of Insulin.

IN a consideration of the mode of action of insulin it is of some importance to know the equivalent relationship between the amounts of hormone and dextrose, that is, the number of molecules of dextrose equivalent to one molecule of insulin. Up to a recent date this ratio was not known, on account of lack of knowledge of the molecular weight of insulin. A recent communication to NATURE[1] from Prof. The Svedberg has, however, provided the necessary information on this point. The molecular weight of 35,100 deduced