will be contracted and extended in opposite quadrants until at 45° they are divided by two diagonals, on each side of which the colours are complementary. Beyond 45° the rings begin to coalesce, until at 90° the four quadrants coincide again. During this movement the centre has changed from bright to dark. If the motion of the analyser be reversed, the quadrants which before contracted now expand, and *vice versâ*. Again, if the crystal (say positive) be replaced by another (say negative), the effect on the quadrants of the rings will be reversed. This method of examination therefore affords a test of the character, positive or negative, of a crystal.

A similar process applies to biaxal crystals; but in this case the diagonals interrupting the rings are replaced by a pair of rectangular hyperbolas, on either side of which the rings expand or contract, and the effect is reversed either by reversing the motion of the analyser, or by replacing a positive by a negative crystal, or *vice versâ*. The experiment may then be made in biaxal crystals, by turning the analyser slightly to the right or to the left, and observing whether the rings advance towards or recede from one another in the centre of the field. In particular, if, polariser and analyser being parallel, the plate A have its axis in a N.E. direction to a person looking through the analyser, the plate B its axis in a N.W. direction, and the crystal be so placed that the line joining the optic axes be N.S., then on turning the analyser to the right the rings will advance to one another if the crystal be negative, and recede if it be positive. The mathematical expression for the intensity of the light at any point P is in this case

$$\tfrac{1}{2}\,(1 + \sin.\,2\,j\cos.\,\theta + \sin.\,2\,b\cos.\,2\,j\sin.\,\theta),$$

where b is the angle between the principal section of C through P and the principal section of B, and j the angle between the principal sections of B and the analyser. This shows that when the polariser and analyser are parallel or crossed at 0° or 90°, and consequently $j = 45°$ or $135°$, the expression is independent of b, *i.e.*, the intensity is the same throughout circles about the centre, but that when the polariser and analyser are crossed we have an expression of the form

$$\tfrac{1}{2}\,(1 \pm \sin\,2\,b\sin.\,\theta),$$

the sign of the second term depending upon the direction in which the analyser has been turned, and also upon the sign of θ, that is, upon the character (positive or negative) of the crystal.

The dispersion of the planes of polarisation effected by the passage of plane polarised light through a plate of quartz cut perpendicular to the axis may be rendered visible by interposing such a plate of quartz between the polariser and a uniaxal or biaxal crystal, when the analyser is at 90°, *i.e.*, when dark brushes are formed. In this case the brushes cease to be black, and are tinged throughout with colour. The analyser must, however, be turned back or forward, according as the quartz be right-handed or left-handed, in order that it may cross in succession the planes of polarisation of the different coloured rays, and so produce the most vivid effects. The dispersion of the brushes by a plate of quartz may, however, be studied by employing an additional polariser and quartz plate between the source of light and the whole system previously used. By turning this polariser round we extinguish each ray of the spectrum in turn, and tint the whole field with the complementary colour. The brushes will then appear to revolve about their centres as the tints vary continuously from one end of the spectrum to the other. If the polariser be turned still farther round, the tints which had changed continuously from red to violet, or *vice versâ*, change suddenly from violet to red, or *vice versâ*, and the brushes jump suddenly back to their original position.

This last optical arrangement may be employed to examine the more important phenomena of the dispersion of the optic axes produced, not by a quartz plate between the usual polariser and crystal, but by certain biaxal crystals themselves.

BOTANY

The Leaves of Drosera

In a recent note to the Paris Academy of Sciences, M. Ziegler writes as follows:—

The hairs on the leaves of Droseras exude at their extremity a small drop of glue, by which insects are caught. Whenever an insect becomes attached, the exterior threads bend over it, covering it like the fingers of a hand, and do not straighten again till some days after, when a fresh drop exudes for a fresh prey.

In studying these remarkable plants, I noticed that all the albuminoid animal substances, if held for a moment between the fingers, acquired the property of making the hairs of the Drosera contract. I also observed that such substances, when they had not been in contact with a living animal, had no visible action on the hairs. This shows that the simple contact of the fingers communicates to inert animal substances a property which they did not possess before.

These same animal substances thus prepared lost this singular property when they were moistened several times with distilled water, and dried each time in a water-bath. This is a convenient mode of preparing the substances for experiment.

The contraction of the hairs is not caused by animal heat, which the fingers may have communicated to the animal substances, for the hairs contracted equally when the substance had been cooled before placing it on the leaf.

The perspiration of the fingers cannot affect the phenomenon, for the property can be communicated to animal substances across fine waxed paper. And the result is not affected if the substances are first covered with a coating of wax, thus preventing any chemical action of soluble matters which the animal substances may contain.

A living animal thus communicating by simple contact new physical properties to an inert body, it was important to know whether, by increasing the amount of transmission, we should observe any change in the vital state of the animal. Some rabbits were enclosed in light wooden cages. These were of such a size that their sides were always in contact with the hairs of the animal at one part or other. To the outside of the cage were attached bags of cloth or paper, containing (for each cage) two kilogrammes of dried serum (albumen from blood). Other rabbits were placed in exactly similar cages, but without the albumen. Their food consisted of 25 grammes of hulled oats every twenty-four hours, with cabbage leaves at discretion.

At the end of some days, the rabbits that had been in contact with the albumen became diabetic in a high degree (though without saccharine matter); the urine was given in normal quantity, but the loss in ammoniaco-magnesian phosphate was very great, and these rabbits deteriorated and lost weight. The other rabbits, which had not been in contact with albumen, remained in their normal state, and even gained weight.

It was interesting to ascertain if the avidity of the Drosera for insects was insatiable, and to find what would be the effect on it of increasing the contact of a living animal. Some dozens were accordingly placed, with a small clod of earth and sufficient water, in light platinum capsules. These capsules were each placed in a sheath containing blood albumen, which had previously been held for half an hour in the hand. At the end of twenty-four hours all these Droseras had become quite insensible to insects and to organic animal bodies modified by living contact. The properties of these plants were reversed, and strange to say, their hairs were found to contract under the influence of organic matters which had previously been in contact with paper packets (of double or triple envelope) containing sulphate of quinine. Organic matters influenced in this purely physical manner by sulphate of quinine have no contractile action on the hairs of the Drosera in their normal state. The plants whose physical properties have been reversed by the influence of albumen in the above way, could be restored to their normal state by placing them for twenty-four hours with the platinum capsule on a packet of sulphate of quinine. This method may be adopted whenever, from any cause, the leaves have become insensible to insects. In every case the contraction of the hairs is always slow; it commences visibly in about a quarter of an hour, and is often not complete till after several hours.

Among vegetable matters seeds only are impressible in the way referred to, and the experiments mentioned (which were made with albuminoid animal substances) may be repeated with these.

Nature of Diatoms

In a recent essay by Prof. Adolf Weiss, of Lemburg ("Zum Baue und der Natur der Diatomaceen"), it appears to be demonstrated that the siliceous investment of these little plants has cellulose for its base. The silex is infiltrated to a variable extent in the different families, and the mode of its deposition can to a certain extent be ascertained by examination with polarised light. In opposition to the opinion hitherto generally admitted, Prof. Weiss shows that the siliceous coal is capable of