shock which was below the threshold of my perception. With a stronger shock the cellular contraction was more intense; under excessively strong shocks the contractile spasm became very violent; after a short time the tissue ceased to respond, being effectively killed by the electric discharge. It is quite easy to show that the cortical cells in every section of the stem and of the leaf-joint are fully sensitive, proving a continuity of contractile cortex throughout the length of the plant. A wave of peristaltic contraction may thus sweep onward from the point of stimulation.

(3) *The Movement of Sap.*—The following striking experiment affords conclusive proof that the movement of sap is essentially not a physical but a physiological process. A cut piece of stem of *Antirrhinum* with a pair of opposite leaves is suitably fixed at the cut end in a piece of sponge. Under excessive drought the leaves fall down, become crumpled up and are wilted. A few drops of cardiac stimulant—dilute solution of camphor—applied on the sponge bring about a striking transformation. The drooped leaves are quickly revived; they rear themselves up with great rapidity, and become fully erect in the course of 2-3 min.

(4) *Active Cellular Pulsation in Propulsion of Sap.*—The pumping of sap by the propulsive tissue is clearly demonstrated by the optical sphygmograph. The flow of sap along the stem is observed to consist of a series of pulsations. The pulsatory activity is greatly increased by drugs which enhance cardiac activity in the animal; it is enfeebled or arrested by depressing agents. Extracts from certain Indian plants have a potent influence on the propulsive activity of the plant and the cardiac activity of the animal. This aspect of the investigation has roused considerable interest in the Medical Faculty of Vienna.

(5) *Movement of Sap in Sealed Stems.*—It has been thought that the movement of sap is essentially due to push from below by root-pressure and suction from above by transpiring leaves. The fact that there is an inherent activity in the stem itself, independent of those in the terminal organs, is clearly demonstrated by experiments on an isolated stem covered with impermeable varnish. The sap can now be made to flow either upwards or downwards, according to differential stimulation. The law of directive movement of sap is that it moves from the stimulated to the unstimulated or depressed region. The cellular mechanism is highly sensitive, being automatically adjusted for subserving the well-being of the plant. A local depression or stimulation makes the sap rush towards the depressed or away from the over-stimulated region. It is in this way that chemical substances stored in one region are conveyed to distant parts. By this hydraulic mechanism the plant as a whole becomes an organised unity.

I have seen Sir J. C. Bose carry out the experiments described above, and can confirm, since I have repeated some of them with Sir J. C. Bose's apparatus, that the results are as he has described.

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Polarisation of Scattered Light-quanta.

It is well known from the work of Barkla, Compton, and others that X-rays scattered through 90° by matter are completely polarised, irrespective of whether the electron remains bound or suffers ejection from the atom as the result of the impact of the quantum upon it. The recent discovery of a new type of light scattering with altered frequency (NATURE, May 5, p. 711) makes it of importance to ascertain whether a light-quantum which is scattered

with diminished energy is less perfectly polarised than in the ordinary case.

We have investigated this question with several liquids by analysing the scattered light with a spectrograph having a suitably orientated Nicol placed in front of its slit. The results obtained are extraordinarily interesting, as will be seen from Fig. 1. Fig. 1 (b) represents the spectrum of the incident light from the mercury arc. Fig. 1 (a) represents the spectrum of the scattered light from liquid benzene, the upper and lower halves of the spectrogram corresponding respectively to the two principal directions of vibration. It is seen that some of the new lines which appear only in the scattered spectrum are actually polarised much more completely than the lines present in the incident spectrum. Further, the degree of polarisation varies greatly from line to line, some of the new lines being strongly polarised, others only very partially so. So large are the differences in polarisation that the relative intensity of the lines is quite different in the upper and lower halves of the spectrogram. In the case of amyl alcohol as well

FIG. 1.

(Fig. 1 (c)) the new lines in the scattered spectrum are polarised to varying extents, and the continuous radiation appearing in it is also partially polarised.

The strong polarisation of the modified light scattering is intelligible in view of the analogy with the Compton effect. Since the different modified lines represent different electronic transitions induced in the molecule by the incident radiation, the varying extents of their polarisation may be interpreted as due to the optical anisotropy of the molecule being very different for different types of deformation. That some of the intense modified lines are polarised even more strongly than the unmodified lines need not occasion surprise, if we remember that the classical light scattering in a liquid is much less perfectly polarised than the scattering by the molecules of the corresponding vapour. If we assume that the modified scattering is an incoherent type of radiation, we should expect its intensity to be proportional to the density of the fluid, and its polarisation to be comparable with that of the classical scattering in the corresponding vapour (not liquid). These expectations appear to be not very far from the truth.

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Molecular Measurements by Optical Lever.

FOLLOWING preliminary experiments performed more than two years ago, I have now arranged an optical lever of precision, giving very large magnification, and applied it to test (a) the accuracy with which a steel-to-steel contact will return after separation, and (b) whether the thickness of a mica sheet can be