precipitate tends to form on any solid surface placed in the solution. The electrodes thus become coated with barium carbonate and the 'cell constant' rises towards infinity. This is readily prevented by a simple device: the electrodes are kept in mercury at the base of the baryta tube in which the carbon dioxide is being absorbed. When it is desired to estimate the quantity of carbon dioxide which has been absorbed, the gas stream is stopped and the mercury is lowered and the baryta comes in contact with the electrodes, the conductivity is measured, and the electrodes are again covered with the mercury and the gas stream is started again.

The diagram of the apparatus is almost self-explanatory. Absorption of oxygen by the plants causes the solution in the manometer *CD* to rise into tube *C*, thus bringing the electrode *c* into electrolytic connexion

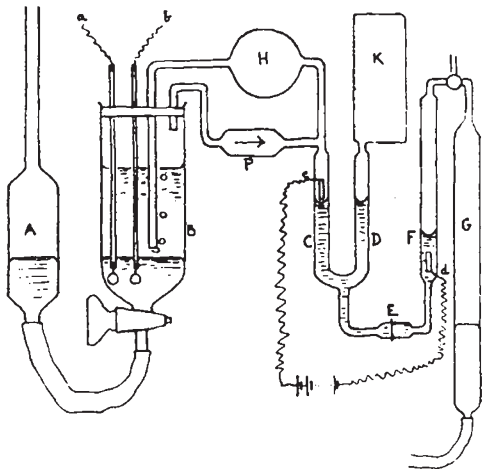

FIG. 1.—*A*, tube for altering level of mercury in *B*: *B*, carbon dioxide absorption tube: *CD*, manometer: *E*, parchment membrane: *G*, gas burette: *H*, plant chamber: *K*, compensator: *P*, circulating pump. Electrodes *a* and *b* are connected to a Wheatstone bridge.

with *d*. The parchment membrane *E* allows this movement of ions, but prevents changes in the gas pressure in the tube *F* from affecting the volume of the gas in the circulating system and compensator. The gas burette *G* serves to estimate the hydrogen evolved simultaneously with the oxygen.

The volume of the circulating gases fluctuates to an extent of about 0·07 c.c. on each side of the mean volume, and this defines the limit of accuracy with which the rate of oxygen intake can be estimated.

The relationship between the resistance of the baryta and the quantity of carbon dioxide which it has absorbed is most conveniently obtained by calibrating the apparatus with known amounts of carbon dioxide. The magnitude of the change in resistance for a given quantity of carbon dioxide increases as the process of absorption proceeds. Using *N*/20 baryta, 1 mgm. carbon dioxide brings about an increase in resistance of roughly 10 per cent.

It is hoped that full details both of the calibration and 'rapidity of response' of the apparatus will shortly be published.

It may be noted that the fact that the circulating gas-system is closed throughout the course of the experiment makes this method particularly accurate, and useful when gas mixtures other than air are used in the investigation.

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Feb. 28.

Crossed Connexion of the Cerebral Hemispheres with the Muscles and Sense Organs.

I WISH to thank Dr. Creed for his letter in NATURE of Mar. 1 with its references.

I am afraid that in my attempt to be brief I may have misled Dr. Creed in one or two details. I agree with him that the crossing of both afferent and efferent impulses seems a very clumsy arrangement, but my desire was to suggest a way in which this remarkable state of affairs might have been brought about.

I did not mean to suggest that the median eye is the forerunner of the two lateral eyes. In view of the number and variety of eye-like structures in invertebrates, it seems that such organs can be easily developed; in fact, in *Sphenodon* there are two lateral eyes as well as a single median one. The parapineal organ may be the remnant of the primitive median eye, and if so the well-developed structure in *Sphenodon*, even if it is not functional, is worthy of investigation. Perhaps some comparative anatomist can throw light on this possible relationship. I did not refer to *Sphenodon* previously because the crossed connexion occurs in fishes, hence the origin of that condition must have been in a more primitive organism. If the pineal eye of *Sphenodon* does represent the same structure as the eye of an ascidian larva, it is curious that the organ seems to have nearly disappeared in fishes.

I look upon the original crossing as efferent. There is no need in the ascidian larva for an afferent crossing, as the optical images would be formed on the crossed side. Where the crossing occurs and how many neurones are involved in the path to the muscles, I do not know, but in so far as the impulses are concerned with the production of movement they are efferent.

When the crossed connexion had been established, the parts growing from that region would all be crossed and the afferent impulses would have to cross in order to link up with the efferent paths. It is remarkable, however, that a new uncrossed system did not develop when lateral eyes became predominant. As pointed out by Dr. Creed, Ramón y Cajal's suggestion is out of harmony with the cortical distribution of the retinal areas in man.

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Mar. 10.

Indeterminacy in Physics.

THE Principle of Indeterminacy in physics, to the history of which Sir Joseph Larmor has directed attention in NATURE of Mar. 8, is sometimes referred to as though it might develop so as to dissolve all physical laws. It is well to point out its limitations. Its present phase is no more than the search among physical statements for their minimum content, rejecting repetition and superfluity. From this point of view it is the necessary continuation of the chapter of upheaval of ideas introduced by Relativity, which dissolved so much.

It is only by mathematics that superfluous statements, so subtle that they have hitherto evaded detection, can safely be analysed. But mathematics is a closed chain of argument that reveals nothing that is not put into the chain originally; and physics, upon which it works, has been so far explored, that apart from detail, we know what it is going to say. What it is going to say is, to attempt to describe the universe without Will or Purpose. It does so, not because anyone believes that to be possible, but because those things are unmanageable by mathematics and have,