rôle of carbohydrates in the physiology of the living cell has been recognised for a very long time, our knowledge concerning the direct penetration of living cells by carbohydrate molecules is only recent. Scarcely anything is known, however, about the effect of sugar on the permeability changes of cell membranes to diffusion of sugar molecules. Curiously, the direct evidence for an effect of this kind of sugars on the permeability of cell membranes is obtained from an investigation which had primarily nothing to do with the problem.

The investigation was concerned primarily with the study of respiratory intensity when starved and unstarved leaves were injected with varying concentrations of glucose solutions. The curves obtained in that connexion could not all be explained on the basis of a simple relationship between concentration and respiratory intensity, for which an explanation had to be sought.

Observations of the rates of respiration were recorded on the control and the experimental leaves simultaneously. For purposes of analysis, from the curves thus obtained the per cent algebraical increase of respiration of the experimental leaves over the controls have been calculated and exploited.

The equations for the curves of the hourly march of these values work out in a very simple way in the majority of these curves. They can be expressed as simple logarithmic curves.

For comparing the relationship between the concentration of sugar solutions and the respiratory intensity, the *initial* values obtained by extrapolating these curves to zero time have been plotted against the corresponding concentrations.

The generalised curves thus obtained at different temperatures show an ascending and a descending phase. It is the ascending phase which forms the special feature of this communication. This phase shows the mathematical relationship $R = K \cdot Ct^n$, where R is the rate of respiration, Ct the concentration, K a constant, and n an index which is greater than unity, that is, respiration increases relatively more as concentration increases. This is explained in terms of the relatively greater rate of diffusion of sugar molecules as concentration increases. The only way in which this can happen is through variations in the permeability of cell membranes to the diffusion of sugar molecules as the concentration of glucose solution increases, thus supplying direct evidence of the effect of glucose on the permeability of cell membranes.

In the equation given above, K represents the diffusibility factor for the diffusion of sugar, which would vary at different temperatures, and the index n the factor for variations in the permeability of cell membranes as the concentration of the solution increases.

In view of these results, the effect of various carbohydrates on the permeability of cell membranes must be known before one can investigate their quantitative effects on various physiological processes of metabolism, such as respiration, etc.

R. S. INAMDAR.
K. V. VARADPANDE.

Benares Hindu University, India,
Oct. 20.

A Lantern Slide Model of the Wave Electron.

LECTURERS on the more popular aspects of the wave-electron may be interested in a simple lantern slide model for demonstrating the waves which I have not seen previously described. Based directly on an explanation given by de Broglie in his "Recherches sur la Théorie des Quanta" (*Ann. de Physique*, 3,

p. 22; 1925), it has the advantage not only of showing the waves to an audience, but also of giving perhaps some insight into their nature. The model consists merely of the diagram of lines shown in Fig. 1, which can be pushed horizontally in the lantern behind a fixed vertical slit.

FIG. 1.

The figure represents the space-time diagram of the observer of a moving electron. The observer is represented by the successive points of his time line OT , while of his space axes only OX is drawn. The time line of the electron, in motion with respect to the observer parallel to OX , is OT' . Now the electron has a known energy, $w = mc^2$, which on the electromagnetic theory is spread out in space round it, and also associated with the electron in some way (perhaps it is rotating with a fixed angular momentum), an elementary quantum of action, h , has to be admitted. From these known quantities we can deduce a certain time,

$$\tau = \frac{h}{w}$$

(8×10^{-21} sec. for slow motion), and the diagram can be divided into cells, each containing the action h , by lines separated by intervals τ (measured along OT'). These lines, representing instantaneous spaces associated with the electron, must be drawn perpendicular to OT' . It is, however, a well-known feature of the pseudo-Euclidean geometry of space-time that a line which satisfies the analytical conditions of perpendicularity to OT' lies actually parallel to OX' , where $\angle XO'X' = \angle TOT'$ when the velocity of light is taken as unity. The lines, $A_1, A_2 \dots$, separating the successive action cells, appear consequently as shown.

Now when the slide is covered by an opaque screen with a slit S in it, and the diagram is moved behind it from right to left, we see the electron E moving up the slit with the velocity v , while a train of phase waves, formed by those parts of the lines between the cells of action which show through the slit, passes up through the electron with a velocity c^2/v in a very realistic way. Transparent lines on a dark background give the best effect. S. R. MILNER.

The University,
Sheffield.

The Subdivisions of the Order Primates.

IN his Croonian Lecture on "The Developmental History of the Primates", Prof. J. P. Hill referred to the late Dr. Hans Gadow's subdivision of the Primates into three sub-orders for reasons which I have previously explained in some detail (*NATURE*, May 2, 1907, vol. 76, p. 7, and *Proc. Zool. Soc. Lond.*, 1919, published Feb. 1920, p. 465).

My colleague has suggested that I should put on record the circumstances in which Dr. Gadow created the sub-order called by him 'Tarsii'.