a biconcave shape would invite this alteration. It seems plausible that the delicately constructed and highly flexible erythrocyte is more easily subject to distortion, through the action of reagents, than are ordinary tissues for it is not supported by contiguous cells or by intercellular cement.

The following experiment of Löhner ('11),[16] which I have corroborated, is interesting from this viewpoint. If a droplet of blood be drawn by capillarity between cover slips,[17] fused at one point, discs are observed. If now 1 per cent. osmic acid be drawn in cautiously from one side only, many cups, some wedge-shaped discs, discs, and distorted forms are seen.

A limited number of cup-shaped erythrocytes undoubtedly exist in normal blood. Possibly they represent corpuscles, whose structure is such that unequal tensions with respect to the osmotic balance exist; perhaps they are old (or young?) corpuscles. In anemias the presence of many cups have been reported, and in fevers it is said crenation may occur. May it not be that the blood of certain individuals contains "normally" excessive numbers of cup-shaped corpuscles? Is it possible that this explains why some of our most careful workers have been led to describe this form as normal?

The evidence gained from the examination of drawn blood, diluted in human serum, and from the study of circulating blood in non-anesthetized living mammals justifies, I believe, the conclusion that the biconcave disc represents the normal shape of the mammalian erythrocyte—the concavo-convex cup being merely an occasional modification.

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THE PENETRATION OF BALANCED SOLUTIONS AND THE THEORY OF ANTAGONISM

ANTAGONISM has been explained by Loeb and by the writer on the ground that antagonistic substances prevent each other from entering the cell. As the writer has repeatedly pointed out,[1] this explanation encounters a difficulty in the fact that antagonistic substances penetrate the cell in a balanced solution (although the penetration is much slower than in unbalanced solutions). The proof of this has been obtained by the writer by means of the method of plasmolysis[2] as well as by determining electrical resistances[3] and it has recently been confirmed by Brooks[4] by means of the method of tissue tension as well as of diffusion through a disk of living tissue.

It is obvious that antagonistic substances must penetrate in a balanced solution since otherwise the cell could not obtain the salts necessary to its existence.

As a way out of this difficulty the writer has suggested[5] that the slow penetration of salts may produce effects quite different from those produced by rapid penetration, just as the precipitation of colloids may be brought about by the rapid addition of salts while it does not take place when they are added slowly.

This difficulty completely disappears if we adopt the standpoint recently advocated by the writer in developing a dynamical theory of antagonism.[6] From this point of view we regard the slow penetration of salts in balanced solutions not as the cause but as the result of antagonism, or rather we may regard both the slow penetration and the increased length of life (or growth, etc.), by which we measure antagonism, as the results of certain life processes which are directly acted on by the antagonistic substances.

The essential feature of the explanation lies in the behavior of these life processes rather than in the manner or rate of penetration.

It is assumed that these life processes consist of consecutive reactions of the type

$$A \rightarrow M \rightarrow B$$

[16] Löhner, L., *Arch. f. gesam. Physiol.*, Bd. 140, pp. 92–108, 1911.

[17] Blood should occupy part of the capillary space only.

[1] SCIENCE, N. S., 34, 189, 1911; 35, 115, 1912; 36, 576, 1912. *Plant World*, 16, 135, 1913.

[2] SCIENCE, N. S., 34, 189, 1911.

[3] SCIENCE, 35, 115, 1912; 36, 576, 1912. *Am. Jour. of Botany*, 2, 93, 1915.

[4] Unpublished results.

[5] SCIENCE, N. S., 34, 189, 1911; 35, 115, 1912; 36, 576, 1912. *Plant World*, 16, 135, 1913.

[6] *Proc. Am. Phil. Soc.*, 55, 1916.

in which M is a substance which determines the rate of penetration of salts and the electrical resistance of the protoplasm.

If the antagonistic substances are NaCl and $CaCl_2$ it appears that $CaCl_2$ accelerates the reaction $A \rightarrow M$ while both $A \rightarrow M$ and $M \rightarrow B$ are inhibited by a salt compound formed by the union of NaCl and $CaCl_2$ with a constituent of the protoplasm.

From this standpoint the slow penetration of antagonistic substances should not have unfavorable results provided these substances are properly balanced at the start and remain so (*i. e.,* if their relative proportions are not too much changed by unequal speed of diffusion, precipitation, chemical union, etc.) after they enter the cell. For they must affect the life processes mentioned above in quite the same way in the interior of the cell as at the surface[7] and these life processes will go on in the normal way so long as the antagonistic substances within the cell remain properly balanced.

The result will be the preservation of normal permeability as well as of all other properties essential to life.

It has been shown by the writer[8] that the normal permeability may be regarded as a sensitive and accurate indicator of health and vitality. All factors which disturb it bring about temporary or permanent injury and eventually produce death if the action be sufficiently prolonged. It is therefore evident that the life processes which preserve normal permeability are of peculiar importance and that the manner in which they are influenced by antagonistic substances is of especial interest. Methods are being developed for the study of these questions and it appears probable that a considerable amount of information can be obtained in regard to the nature of these processes.

Summary.—Antagonism has been explained by assuming that antagonistic substances prevent each other from entering the cell. A difficulty is found in the fact that they slowly penetrate the cell even in a properly balanced solution. This difficulty disappears if we suppose that the antagonistic substances affect certain life processes which control permeability. So long as they are present in the right proportions their effect on these processes is favorable and their penetration into the cell can do no harm.

The preservation of normal permeability may therefore be regarded as the result rather than as the cause of antagonism.

[7] Whatever effects are found at the outer surface of the cell are doubtless to be found also at many of the internal surfaces such as the surfaces of vacuoles, plastids, microsomes, etc.

[8] *Plant World,* 16, 143, 1913. Science, N. S., 40, 488, 1914.

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THE DETERMINATION OF RELATIVE HUMIDITY

In the present stage of knowledge of what constitutes healthful and comfortable air for the average healthy person, the question of the value and significance of the determination of relative humidity is still decidedly debatable. It will, therefore, be necessary to continue such determinations in connection with other types of ventilation tests, in order to assign to relative humidity its proper value as a factor in the problem of conditioning air for health and comfort. There is at least one standard procedure for this determination—the use of the sling psychrometer. This instrument is supposed to give reliable results if used in accordance with the government directions. One need not spend the fancy price for the instrument de luxe. Two thermometers, firmly lashed together in such a way that the bulb of one projects beyond that of the other gives perfect satisfaction. The lower bulb is moistened in the usual way and the pair is swung by a strong cord.

This method has obvious limitations. It can not be used under many circumstances where the determination of relative humidity is desired, *e. g.,* in crowded places, between skin and clothing, etc. It is ofttimes inconvenient and dangerous to use, *e. g.,* in conspicuous places such as churches and libraries, and in cramped quarters such as the berths of