ber of points of discussion—these are the points which make a popular text for students. De Fursac and Rosanoff's book has gained a well-deserved place with medical students through these qualifications, and it will deserve it even more fully in the present form. Up to the present edition the text kept apart the translation and the translator's annotations. This distinction has been obliterated and in reality the book has been adapted much more definitely to the needs of the American student, at least in the chapters entitled "The Practise of Psychiatry," which give a helpful picture of the present-day dispensary and state hospital practise.

The book represents a somewhat extraordinary combination in view of the fact that it is primarily an adaptation of the German psychiatry to a French public and then a readaptation to the American viewpoints. French psychiatry has in the meantime shown some evidences of revolt and repudiation, and American psychiatry, if we can speak in such a summary way, shows signs of a considerable degree of emancipation. For the purposes of the student, however, it is most important that he get some reasonably clarified starting point, and with the qualifications of the original description by Rosanoff, the transition is made reasonably easy and will no doubt offer a good basis for further emancipation as further editions will demand it. It may be possible to eliminate some unnecessary evidences of translation such as the reference on page 21 to Jean Muller, whom probably most of us know as Johannes Mueller.

"In the first part of the book, the chapters dealing with etiology, history taking, methods of examination, special diagnostic procedures, general prognosis, prevalence of mental disorders, prevention, and medico-legal questions, and, in the second part, those dealing with Huntington's chorea, cerebral syphilis, and traumatic psychoses are either wholly new or almost so.

"The chapter on general therapeutic indications, in the first part of the book, and those on dementia præcox, chronic alcoholism, general paresis, and mental disorders due to organic cerebral affections, in the second part, have been more or less extensively revised or added to."

Rosanoff's standpoint with regard to heredity is very strongly emphasized in the book to the effect that he feels that "we are in a position to say to the people and to legislatures: Mental health is purchasable; the prevalence of mental disorders can be reduced for coming generations with the aid of dollars and cents spent for segregation in this generation."

For the problems of non-institutional care it might be wrong to expect too much help from a book. The problem of psychotherapy is treated rather briefly, but is one of those things that have to be learned from practise and with the help of special literature.

ADOLF MEYER

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SPECIAL ARTICLES

A SUGGESTION REGARDING THE MECHANISM OF ONE-SIDED PERMEABILITY IN LIVING TISSUES[1]

IT is a familiar fact to physiologists that a large proportion of living tissues display a type of permeability markedly differing from the permeability or semipermeability of the majority of non-living membranes in that it is dependent upon direction, that is, upon the side of the membrane exposed to the dissolved substance. Among the almost numberless illustrations of this phenomenon which might be adduced it will be sufficient to cite the experiment of Cohnheim[2] in which a glucose solution, free from sodium chloride was introduced into an isolated loop of intestine. After the lapse of a certain period investigation of the residual fluid showed that while some fifty per cent. of the water and glucose had passed through the wall of the intestine into the blood stream, only an insignificant trace of sodium chloride had passed from the blood stream into the glucose solution. This is not the

[1] From the department of biochemistry, Rudolph Spreckels Physiological Laboratory, University of California.

[2] O. Cohnheim, *Zeitschrift f. Biologie*, 36 (1898), p. 129.

case if the glucose solution be placed in the peritoneal cavity instead of in the intestine. In this case the peritoneal wall behaves like a membrane of parchment. Not only water, but also dissolved substances traverse the membrane in both directions with equal facility, so that after a certain lapse of time the residual glucose solution is found not only to have parted with glucose, but also to have gained from the tissue fluids a very appreciable proportion of sodium chloride.

The phenomenon of one-sided permeability is perhaps nowhere more strikingly illustrated than in the tissues of the kidney which pick out urea from the blood, although present therein in minute concentration, and secrete it into the secretory tubules of the kidney against a relatively enormous osmotic pressure. The epithelium of the kidney is evidently permeable to urea in the direction blood $\rightarrow$ urine, but under normal conditions must be impermeable or very nearly impermeable to urea in the direction urine $\rightarrow$ blood. That the one-sided permeability of the kidney is dependent upon the maintenance of the normal structure of the renal epithelium is revealed by its failure in pathological conditions involving partial destruction of the renal epithelium and also by the striking experiment of Bottazzi[3] in which he compared the excretion of the right and left kidneys of the same animal after injury of one of them by sodium fluoride; for while the uninjured kidney secreted urine which was markedly hypertonic in comparison with the blood, the injured kidney secreted urine which was actually hypotonic in comparison with the blood.

It is obvious that the phenomenon of one-sided permeability must be dependent upon a heterogeneous structure of the membrane which displays it. The phenomenon is not and could not be displayed by structureless membranes or by membranes having a uniform structure in the direction of penetration, *i. e.*, perpendicularly to their surface. Nor would any structure of macroscopic dimensions, *i. e.*, involving structural elements of a size far in excess of the mean free path of the molecules, suffice to endow the membranes with this peculiar property. We must therefore seek for the interpretation of the phenomenon in the minute structure of the cell.

A specific arrangement of permeable and relatively impermeable phases of the cell-substance would appear to offer the only reasonable basis for interpretation of the phenomenon. In seeking for constituents of protoplasm which are impermeable or but slightly permeable to the majority of substances dissolved in water the lipoids immediately present themselves as the constituents of the cell most markedly differing from the remainder of the protoplasm in their solubilities and solvent power.

That lipoids are present in abundance in living cells either in combinations of such a character as to mask their micro-chemical properties or in particles so small as to be of very nearly ultramicroscopic dimensions is very strikingly shown by the investigations of Athanasiu,[4] Taylor[5] and others who have shown that the tissues of the liver and other organs in the fatty degeneration induced by phosphorus poisoning do not necessarily contain more and indeed may contain slightly less fat than the corresponding normal tissues. In other words, the fat which is present in the tissues of phosphorized animals in the form of microscopically visible aggregates, is present in the corresponding normal tissues in aggregates too small to be identifiable by staining reactions. The same inference may be drawn from the observation of Gay and Southard[6] that in animals which have experienced anaphylactic shock the gastric epithelium is loaded with visible fat globules, whereas normal gastric epithelium is free from visible fat. In the brief period which elapses between the administration of the foreign protein and death in anaphylactic shock there is no time for transmissal of fat from

[3] Bottazzi, F., *Archivio di Fisiologia*, 1 (1904), p. 273.

[4] Athanasiu, J., *Arch. f. d. ges. physiol.*, 74 (1899), p. 511.

[5] Taylor, A. E., *Jour. of Exper. Med.*, 4 (1899), p. 399.

[6] Gay, F. P., and Southard, E. E., *Jour. of Med. Research*, 16 (1907), p. 143.

one tissue of the body to another. We must assume that the fat in the gastric epithelial cells is present in normal animals in ultramicroscopic or very nearly ultramicroscopic aggregates, and that the circumstances attendant upon anaphylactic shock have merely induced coalescence of the preexisting fat granules into aggregates sufficiently large to be identifiable as fat.

The existence of a considerable proportion of ultramicroscopic fat-granules in living cells which is thus established provides a material basis for the assumption of a diphasic structure in which the one phase is permeable and the other impermeable to substances soluble in water but insoluble or relatively insoluble in fats.

The most usual spatial arrangement of the various structures or constituents of a cell is that of radial symmetry. The primitive arrangement of strictly radial symmetry so frequently displayed in spherical cells becomes modified or distorted in those cells, such as the majority of epithelial cells, which through mutual compression, or for other reasons, have assumed a columnar, stratified or flattened outline. In such cases the radial arrangement of structures may be confined to the sides or margins of the cell or differ in character in the protoplasm underlying the various facets of the cell.

A radial arrangement of the ultramicroscopic fat granules of the cell would obviously lead to the formation upon the surface and in the subjacent protoplasm of minute funnel-shaped pores, of which the interstitial openings would be permeable to substances soluble in water, while the walls, being composed of fat granules, would be impermeable or with difficulty permeable by such substances. The interstitial openings at the margin distal from the center from which the fat granules radiate would be relatively large, while at points lying nearer to the center of radiation, that is, in general, deeper within the cell, even if the radiating lines of globules should not be continued sufficiently far in that direction to actually intersect one another, the diameter of the pores would be very considerably contracted. Substances soluble in water would penetrate such a cell readily, since a relatively large proportion of the cell-surface would consist of the water phase, but they would leave the interior of the cell with difficulty, since a relatively large proportion of the area which they would have to traverse to attain an outlet would consist of the lipoid phase. If the modifications of radial symmetry which are so characteristic of epithelial cells should result in the confinement of this structure to one surface or facet of the cell it is obviously possible that one-sided permeability of a tissue composed of such cells might be the consequence.

It should be borne in mind that the existence of funnel-shaped pores in the surface of a cell or membrane would only give rise to one-sided permeability provided the diameter of the pore at the constricted end were comparable with the mean free path of the penetrating molecules. Were the least diameter of the pores less than the mean free path of a given molecule, then the membrane would be a strictly semipermeable one for this type of molecule; were it, on the contrary, very large in comparison with the mean free path of the molecule concerned, then the membrane would be freely permeable by the molecule in either direction. Thus it is readily conceivable that membranes of this type might exhibit one-sided permeability for certain substances dissolved in water, absolute permeability for others, and semipermeability for yet other molecules.

Any reagent or condition affecting the state of aggregation of the fat globules would necessarily affect the diameter of the pores. In general those conditions involving the formation of large aggregates would increase the permeability of tissue by enlarging the diameter of the radiating droplets and therefore that of the interstitial spaces. Moreover, since the droplets are suspended in a protoplasmic gel, we may infer that in all probability their radial dispersal would be modifiable by alterations of the state of aggregation of the proteins of the cell. The relationship of lipoid solubility and of lipoid solvents and of substances which have a marked effect upon surface tension to the permeability of cells thus find an

intelligible explanation. In the light of the investigations of Clowes[7] and of Fenn[8] upon the influence of inorganic salts upon the state of aggregation of oil emulsions and of proteins in solution it would appear not at all improbable that the striking phenomena of salt-antagonism which Osterhout has shown to depend upon the preservation of minimal cell-permeability, owe their origin to antagonistic alterations of the state of aggregation or displacements of the radial distribution of the lipoid granules of the cell, resulting, when either of the mutually antagonistic salts is present in excess, in enlargement of the interstitial pores.

T. Brailsford Robertson
University of California

THE UTAH ACADEMY OF SCIENCES

The tenth annual convention of the Utah Academy of Sciences was held at Salt Lake City, April 6 and 7, 1917, in the Young Memorial Building.

Four sessions were held beginning as follows: Friday, April 6, at 2 P.M. and again at eight P.M., Saturday, April 7 at 10 A.M. and the closing session at 2 P.M.

President Frank S. Harris occupied the chair at all the sessions.

Dr. Geo. R. Hill, Jr., of the Utah Agricultural College, Dr. Perry G. Snow and Dr. Newton Miller, of the University of Utah, and C. Arthur Smith, of the East High School, Salt Lake City, were elected fellows.

The following were elected to membership: Dr. Orin Tugman, U. U., Professor Walter A. Kerr, U. U., Dr. Frederick S. Pack, U. U., Dr. Joseph F. Merrill, U. U., Professor Elbert D. Thomas, U. U., Mr. James S. Godfrey, U. U., Mr. John W. Sugden, U. U., Dr. Walter D. Bonner, U. U., Professor Hyrum Schneider, U. U., Professor Geo. Coray, U. U., Professor Sherwin Maeser, B. Y. U., Provo, Clarence F. Korstian, Forest Service, Ogden, H. J. Frederick, U. A. C., Professor Clarence J. Sorensen, U. A. C., Logan, Mr. Sidney B. Sperry, Salt Lake City, Mr. L. A. Giddings, East High School, Salt Lake City, Mr. L. Moth Iverson, Salt Lake City, Mr. James W. Jones, Salt Lake City and Mr. Tom Spalding, Provo.

The following are the officers for the ensuing year:

President—W. D. Neal, Salt Lake City.

First Vice-president—Dr. L. L. Daines, U. U., Salt Lake City.

Second Vice-president—Dr. W. E. Carroll, U. A. C., Logan.

Permanent Secretary—A. O. Garrett, East High School, Salt Lake City.

Assistant Secretary—C. Arthur Smith, East High School, Salt Lake City.

Councilors—Dr. Newton Miller, U. U., Salt Lake City; C. Arthur Smith, East High School, Salt Lake City, and Professor Carl Eyring, B. Y. U., Provo.

The following papers and lectures were presented:

"The Pressure-watt Characteristics of Drawn Wire Tungsten Lamps," by C. Arthur Smith, East High School, Salt Lake City.

"The Variation of the Electric Conductivity of Thin Metal Films," by Dr. Orin Tugman, U. U., Salt Lake City.

"The Anastomosing of Arteries and Veins in a Family of Cats," by Dr. Newton Miller and Mr. James Godfrey, U. U. (Paper presented by Mr. Godfrey.)

"Preformation in Modern Science," by Dr. Newton Miller.

"The World without Science" (presidential address), by Dr. Frank S. Harris, U. A. C.

"The Value of Scientific Research in Forestry," by Mr. Clarence F. Korstian, Forest Service, Ogden.

"Comparative Essay on some Birds of Europe and North America," by L. Moth Iverson, Salt Lake City.

"The Effectiveness of the Corrosive Sublimate Treatment of Potatoes," by Mr. Bert L. Richards and Dr. Geo. R. Hill, Jr., U. A. C. (Paper presented by Dr. Hill.)

"Factors affecting the Planting of Various Crops," by Howard J. Maughan, U. A. C.

"Freezing Temperatures in Fruit Buds," by Dr. Frank L. West, U. A. C.

"Sugar Beet Syrup for Young Pigs," by Dr. W. E. Carroll, U. A. C.

"The Present Situation of Rabies in the State," by Dr. L. L. Daines, U. U.

"The Time Element in Voluntary Control," by Dr. Geo. S. Snoddy, U. U.

"The Liquid Sulfur-dioxid Method of determining Aromatic Hydrocarbon Oils," by Mr. Joseph, U. U.

"The Destructive Distillation of Gilsonite," by Mr. Erickson, U. U.

A. O. Garrett,
Permanent Secretary

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[7] Clowes, G. H. A., *Journal of Physical Chemistry*, 20 (1916), p. 407.

[8] Fenn., W. O., *Proc. Nat. Acad. of Sciences*, Washington, 2 (1916), pp. 534 and 539.