Much space is devoted to an analysis of their attitude and condition, as to degree of compression or maceration, the extent to which the twigs had lost their leaves or been otherwise dismembered. Over 130 pages are devoted to the plants, which are very thoroughly discussed and profusely illustrated, and the author's strictures on the multiplication of species by the older authors, especially Geinitz, are well deserved.

The plant material has come out of the mines almost entirely, and its impregnation with bitumen results in the rather rapid deterioration of features, thus rendering the older types almost worthless and necessitating the study of fresh material, of which Weigelt studied over 1,200 specimens and figures nearly 500. The chief plants comprise fragments of fern-like plants (probably seed ferns) among which Callipteris is predominant; pinnules of Taeniopteris —which may be a seed fern or a cycadophyte; Calamite branches and foliage (Asterocalamites); leaf fragments of Baiera; a new type named Archaeopodocarpus, which includes most of the earlier material called Ullmannia; various cones; Voltzia twigs, and considerable pollen.

The book is exceedingly thorough and the evidence is considered from a number of angles, so that it is very stimulating. It also eliminates from the literature of paleobotany many of the pseudospecies of older authors. Whether Weigelt's general picture of the history and ecology will stand, only time will tell. One wonders if the Hercynian folding may be confidently considered to indicate high mountain barriers; or if the Rothliegendes with its coal seams is necessarily a desert deposit because it is prevailingly red in color, although I suppose it is difficult for any one at Halle to think otherwise; also what became of the flood sediments that uprooted and swept the vegetation into the Kupferschiefer, and if the enormous amount of salts in the middle and upper Zechstein could have been furnished in the relatively simple way that Weigelt postulates.

Be this as it may, the book is a model of painstaking research in a relatively new and difficult phase of paleontology, and discusses a region of surpassing interest.

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What is Life? By AUGUSTA GASKELL. Charles C. Thomas, Baltimore, Maryland. 1928. 324 pp.

THIS book challenges the attention by reason of the problem considered and the objective verifiable nature of the solution promised in the early chapters. The author endeavors to solve the immediate problem of abiogenesis and to account for all the characteristics of living forms, not only those thought of as physical but the so-called psychical qualities as well.

The essence of the theory is that at certain critical times the hydrogen atom has formed an unusual physical configuration. In this peculiar atomic condition organic chains are added in an intra-atomic union. These configurations, referred to as the Z systems, are the basis of life phenomena.

Gaskell does not hold to a strictly evolutionary scheme. She holds that the appearance geologically of newer and higher forms followed as a result of tremendous upheavals in the physical environment, which offered opportunity for new and more complex Z systems to arise. Evolution appears to be a genetic progression from lower to higher forms, the more complex Z systems, as an outcome of the law of probability, arising more infrequently than the simpler systems and later.

A point of interest to the psychologist is the dualistic system suggested by the theory. The Z system has definite material properties analogous to those of the ordinary physicochemical system. In addition it has the attributes of the unique Z configuration which are the life properties.

Intelligence is determined by the complexity of the Z system, whose maturation is inversely proportional to its complexity. Gaskell holds that, as a result, the length of the period of infancy must be accepted as a standard of measurement for rating the intelligence of a race or people.

Among the miscellaneous problems theoretically solved by Gaskell is the cause of cancer. Injury to certain cells of the body results in the formation of indifferent cell material in which a critical concentration of ions develops, affording the opportunity for the growth of a neoplasm. The inference is that the conditions following the trauma determine a local independent Z system.

In considering the value of the theory it must be pointed out that Karl Compton, in the Introduction, speaking from the physicist's point of view, states that we know nothing about the assumed Z combination of protons and electrons, and consequently we may consider such a theory possible. It is evident that Gaskell's theory lies wholly within the conjectural realm. The method of unique assumptions affords the possibility of building any number of logical systems in the explanation of any phenomena. The biogen molecule is an attempt to explain vital phenomena in terms of a unique physicochemical situation. A number of other examples of similar attempts in the history of science could be cited.

Notwithstanding a chapter devoted by the author to the possibilities of experimental verification of her theory, we find no evidence that such verification is

possible. Mrs. Gaskell's book can hardly be considered a contribution to the problem of abiogenesis and the nature of life, however interesting it may be as a speculative essay.

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SPECIAL ARTICLES

A POSSIBLE METHOD OF ENHANCING THE THERAPEUTIC ACTION OF ANTI-BACTERIAL SERUMS

THE therapeutic effect of antibacterial serums designed to act directly upon bacteria, as contrasted with antitoxic serums which act on their soluble toxins, has been notoriously disappointing. This seems surprising in view of the demonstration in such antiserums of antagonistic substances which are known to combine with bacteria and lead directly or indirectly to their destruction in the test-tube and even in the animal body. It is our opinion that only one antibacterial serum, namely that directed against the meningococcus, can be regarded as having approached expectation. For many years efforts have been made to increase the effect of such antibacterial serums by intensifying their content in antibodies or by attempting to conserve original antigenic complexes in the bacteria used for immunization. We believe that we may now be in a position to explain the reason for the inadequacy of antibacterial serums in general and to hint at possibilities for its remedy.

In a series of articles for the past ten years, we have been interested in emphasizing the importance of fixed and mobile tissue cells of the mononuclear series (clasmatocytes, polyblasts or histiocytes), particularly as they exist in granulation tissue, in enhancing the natural resistance of animals to localized infections. It has been found that non-specific mobilization of these clasmatocytes causes an area in which they have been accumulated to be markedly resistant to an otherwise extremely pathogenic strain of streptococcus. Moreover, it has been shown[1] that these cells, once accumulated, are, within certain limits, mobile from one part of the body to another in response to a localized infection. For example, the transfer of an irritated omentum containing large numbers of these cells from one animal into the peritoneum of another will, to a moderate degree, lead to increased resistance in the recipient's pleura. It is possible, even, to use the omentum of another animal species, like the guinea-pig, in the rabbit.

[1] Gay, Clark and Linton, *Arch. Path.*, 1: 857, 1926; Linton, *Arch. Path.*, 6: 615, 1928.

Our own experience, as well as the results of others, have brought the realization that this simple accumulation of clasmatocytes, although markedly successful against streptococcus and staphylococcus, does not protect against other micro-organisms such as the *Treponema pallidum*, the Pasteurella group[2] and particularly the pneumococcus. The hitherto unpublished studies of one of us (A.R.C.) with the pneumococcus have thrown an extremely interesting light on this apparent ineffectiveness of clasmatocytes. The prepared pleural cavity of the rabbit, which protects the animal so well against the streptococcus, has not, alone, the slightest effect in protection against the pneumococcus, although the strain of this latter organism employed was apparently of the same grade of pathogenicity as the streptococcus against which marked protection was assured. Washing the pneumococcus led to no greater protection. When, however, the pneumococcus was treated with a small amount of antiserum, a very marked protection resulted. The same sensitized pneumococci in the doses used were rapidly fatal for unprepared rabbits and for rabbits whose pleural cavity exhibited an acute inflammatory exudate. (Polymorphonuclear.)

These results are one step beyond those obtained by Singer and Adler[3] and Tudoranu,[4] who have come to the conclusion that active immunity in animals against both pneumococcus Type I and pneumococcus Type III infections is due to a cooperation of mononuclear cells and the antiserum, the first factor being the more significant one. This explanation is paralleled by a similar explanation of active acquired immunity to the streptococcus suggested by Bass[5] and Kanai.[6] The brilliant experiments of Stuppy, Cannon and Falk[7] still further emphasize the characteristics of active anti-pneumococcus immunity. These authors have recently found that when rabbits are locally immunized against pneumococcus through the respiratory tract a reinfection by this route is harmless, and is accompanied by a massing of mononuclear cells in the alveoli.

Our own experiments, then, have demonstrated that pneumococci differ from streptococci in regard to protective mechanisms in that the former require for disposal not only an adequate number of mononuclear cells, but tropinization by immune serum. The importance of the mononuclear cells, however, remains equally significant in both instances. We have further been able to show that, although two hundred lethal

[2] Halley, Chesney and Dresel, *Bull.*, Johns Hopkins Hospital, 41: 191, 1927.
[3] *Zeit. für Immunitats.*, 41: 418, 468, 1924.
[4] *Annal. Pasteur*, 40: 606, 1926.
[5] *Zeit. für Immunitats.*, 42: 261, 1925.
[6] *Verhand. der Japan. Path. Gesell.*, 9: 126, 1919.
[7] *Proc. Soc. Exp. Biol. and Med.*, 36: 314, 1928.