

appearance is later, and in the higher organisms not until the development of the body is much more advanced.

The germ-cells, after their isolation, take no part in the growth of the organism in which they arise, and their chief association with the other cells of its body is, that certain of the latter are of service in their nutrition. The problem, therefore, for consideration is the mode in which these germ or reproductive cells become influenced, so that after being isolated from the cells that make up the bulk of the body of the parent they can transmit to the offspring the characters of the parent organism. Various speculations and theories have been advanced by way of explanation. The well-known theory of Pangenesis, which Charles Darwin, with characteristic moderation, put forward as merely a provisional hypothesis, assumes that *gemmules* are thrown off from each different cell or unit throughout the body, which retain the characters of the cells from which they spring; that the *gemmules* aggregate themselves either to form or to become included within the reproductive cells; and that in this manner they and the characters which they convey are capable of being transmitted in a dormant state to successive generations, and to reproduce in them the likeness of their parents, grandparents, and still older ancestors.

In 1872, and four years afterwards, in 1876, Mr. Frances Galton published most suggestive papers on Kinship and Heredity (Proc. Roy. Soc. Lond., 1872, and Jour. Anthr. Inst., v., 1876). In the latter of these papers he developed the idea that "the sum total of the germs, *gemmules*, or whatever they may be called," which are to be found in the newly-fertilized ovum, constitute a *stirp*, or root. That the germs which make up the *stirp* consist of two groups—the one which develops into the bodily structure of the individual, and which constitutes, therefore, the personal structure; the other, which remains latent in the individual, and forms, as it were, an undeveloped residuum. That it is from these latent or residual germs that the sexual elements intended for producing the next generation are derived, and that these germs exercise a predominance in matters of heredity. Further, that the cells which make up the personal structure of the body of the individual exercise only in a very faint degree any influence on the reproductive cells, so that any modifications acquired by the individual are barely, if at all, inherited by the offspring.

Subsequent to the publication of Mr. Galton's essays, valuable contributions to the subject of Heredity have been made by Profs. Brooks, Jaeger, Naegali, Nussbaum, Weismann, and others. Professor Weismann's theory of Heredity embodies the same fundamental idea as that propounded by Mr. Galton; but as he has employed in its elucidation a phraseology which is more in harmony with that generally used by biologists, it has had more immediate attention given to it.

Weismann asks the fundamental question, "How is it that a single cell of the body can contain within itself all the hereditary tendencies of the whole organism?" He at once discards the theory of Pangenesis, and states that in his belief the germ-cell, so far as its essential and characteristic substance is concerned, is not derived at all from the body of the individual in which it is produced, but directly from the parent germ-cell from which the individual