

So also reproduction by gemmation as well as the above cases verifies the theory of Pangenesis, in so far that "gemmules" and cells distributed over the organism, apart from the sexual mode can produce and develop the young forms into maturity.

It may seem incredible that the parent organism should be represented by such a multitude of gemmules in so small a compass as the egg. Darwin throws some light on this by means of an illustration. A cube of water, the sides of which might be estimated at one-ten thousandth of an inch in length, would contain between sixteen hundred and thirty-one millions of atoms. This estimate has since been confirmed, so that, after all, it does not seem impossible that all the representative gemmules of the organism are actually contained in the germ cell.

Following Darwin along the same lines, Francis Galton presented a new theory of heredity which represents the sum of all the gemmules in each germ as a "root" or "stirp." This "stirp" he regarded as made up of two elements. One of which has a function of reproducing the species, and the other by cell multiplication reproducing the

individual. The former he called "germ" cells," the latter "body cells." He affirmed that body and germ cells were essentially independent of each other, and that the body cell had little if any effect on the germ cell although complements of each other in the same "stirp." It will be sufficient to merely note at this point that there is much difference of opinion between scientists on this last statement which is referred to farther on in this essay. What Galton believed was, that acquired impressions and alterations made on the parent would not be reproduced in the offspring.

A little later Dr. Weismann presented a similar theory of heredity founded upon the "continuity of the germ plasm." He agrees with Galton that in the living "stirp" there are two distinct kinds of gemmules - body-cells and germ-cells. The body-cell also builds up the individual, and does not affect the succeeding generations. The germ-cell, on the other hand is continuous. The new germ-cells arise, as far as their essential and characteristic substances are concerned, not at all out of the body of the individual but directly from the parent germ-cells.

The following illustration of Dr.