a rapidly moving tail. Leeuwenhoek, Boerhaave, and others, conjectured that these were capable of becoming beings resembling those from which they were formed; and, as several spermatozoa entered the body of the female at the same time, they imagined that a violent contest took place between them, and that all were killed but one, who became the champion of the battle-field.—On this mistake Liebnitz based his Monadology. These lively little beings are his celebrated Monads. Organized bodies, he said, are never produced from chaos or putrefaction, (Epigenesis,) but always from seed or germs, in which there is a pre-formation of the future being; the seeming generation of animals is only an unfolding and kind of augmentation. Haller supported this doctrine of Evolution of pre-existent germs. Bonnet, in 1762, wrote to refute the various systems of Epigenesis, and put forth his theory of *Emboitement*, (disencasement,) which supposes that perfect germs are included within germs, in endless succession, preformed and ready for all succeeding generations. Buffon supposed that organic molecules exist in the food of all living creatures, which are analogous in nature with the various organs that absorb them; and that when the organism is fully developed, molecules from every part of the body, eyes, ears, &c., collect in the generative organs to form new beings.

The doctrine of "pre-existence of germs" formed one of the great questions in the contests between Cuvier and Geoffrey St. Hiliare in 1830. Through Cuvier's influence, always in harmony with "the needs of theology and the party of order," the doctrine became the predominant one, until the promulgation of the cell theory, when the old aphorism of all life is from the egg, which was supposed to contain the pre-existent being, was abandoned, and the doctrine that all cells are from a cell, that is a miraculously created cell, which originated in a species, and which contained, potentially, cells for all the future possible individuals of the same species. Owen says, that while he agreed with Geoffrey in rejecting the doctrine of "pre-existence of germs," he remained the thrall of the doctrine of "pre-existence of cells." He now abandons the cell theory, and says that upon this "rag of pre-existence" Darwin has grafted his theory of Pangenesis.

I will consider Darwin's theory in my next.

Yours, &c., EBORACUM.

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[Nature, whose essence is visibly to act and produce, requires not, to discharge its functions, an invisible mover.]

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[For terms, see seventh page.]

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For the Boston Investigator.

Pangenesis.

(PAN—*all*, and GENESIS—*to generate.*)

MR. EDITOR:—A multitude of phenomena connected with the development of life have been grouped by Mr. Darwin in his work "On the Variation of Animals and Plants under Domestication;" he thinks it is desirable to connect these phenomena by some intelligible hypothesis. The facts which he has grouped are of great interest to every thoughtful gardener, farmer, and stock-breeder, and the hypothesis by which he attempts to connect the facts is of especial interest to the speculative inquirer into the origin of things. Among other phenomena, which he thinks must be related to each other, are the various modes of reproduction. For instance, some plants and animals produce offspring, without sexual intercourse, by gemmation, that is, throwing off buds which form distinct and perfect beings similar to the parent.—Other plants and animals reproduce themselves by fissipation, that is, by spontaneously splitting themselves, each part forming a perfect being; and some animals, as the Hydra or fresh-water polype, and Nais or fresh-water worm, have been artificially divided into as many as forty pieces, and each piece has produced a perfect animal. Other plants and animals require sexual intercourse to produce offspring; which sometimes resemble the male and sometimes the female parent, and at other times they resemble neither, (excepting generally specific resemblances,) but exhibit the characteristics of some remote ancestor. These various modes of reproduction Darwin thinks must be connected by some intelligible bond, which must include, also, the phenomena of reproduction of amputated limbs, which in spiders, lizards, and many other creatures, and even in human beings, have been successively amputated and successively restored on the exact line of amputation, with neither too much nor too little added; he says, also, how can we explain the transmission of abortive and rudimentary limbs which are useless to offspring, or the existence of supplementary members, such as extra heads, arms, legs, or fingers? and by what means is it that the male sexual element in reproduction acts not solely on the ovule, but occasionally on the mother form, as in the case of the orange flower, which, when fertilized with pollen from the lemon, bore fruit having the peel, which forms part of the mother plant, characterized by stripes of the lemon peel?

To explain these and other phenomena, Mr. Darwin proposes his provisional hypothesis of Pangenesis, which implies not only that the whole organization of a plant or animal reproduces itself, but that every separate atom or unit in an organization also reproduces itself. According to this hypothesis, "ovules and pollen grains, the fertilized seed or egg, as well as buds, include, and consist of, a multitude of germs thrown off from each separate atom of the organization."

To support his hypothesis Darwin refers to the agreement of physiologists that the whole organism consists of a multitude of elemental parts which are to a great extent independent of each other. He does not undertake to decide whether every atom of the enormous mass of minute centres of action which compose the various tissues of the body, are derived from cells, and these from pro-existing cells, from plastic lymp, or blastema (protoplasm); but, as every one appears to admit that the body consists of a multitude of "organic units," each of which possesses its own proper attributes, and is to a certain extent autonomous, and independent of all others, it will be convenient to use the terms cells or organic units indifferently, or simply units. Darwin presumes that no physiologist doubts that each bone-corpuscle of the finger differs from the corresponding corpuscle in the corresponding joint of the toe; and there can hardly be a doubt that even those bone-corpuscles on the corresponding sides of the body differ, although almost identical in nature.

Accepting the almost universally admitted doctrine that the cells or units of the body propagate themselves by self-division, retaining the same nature, and ultimately becoming convert-

ed into the various tissues and substances of the body, Mr. Darwin further supposes that each separate unit throws off minute granules or atoms which he calls gemmules, which circulate freely throughout the system, and when supplied with proper nutriment multiply by self-division, and subsequently become developed into units like those from which the gemmules were derived. He supposes such gemmules to be transmitted from the parents to the offspring, and that they are generally developed in the generation which immediately succeeds; but some of the gemmules may often remain in a dormant state, and be thus transmitted through many generations and be at last developed. The development of the gemmules into units he supposes to depend on their union with other partially developed units or gemmules which precede them in the regular course of growth. Gemmules are thrown off not only during the adult state of the organism, but during all the stages of development. In the dormant state the gemmules have a mutual affinity for each other, which leads them to aggregate into buds, or into the sexual elements. Hence strictly speaking, he says, it is not the reproductive organs, nor the buds, which generate new organisms, but the gemmules thrown off by the units themselves throughout the body. The gemmules are formed quite independently of sexual concourse by each separate unit of the body, and are merely aggregated within the reproductive organs, and in sexual reproduction the gemmules aggregated in the male and female organs are mingled.

The assumption of the existence of free gemmules is not very improbable, seeing that cells are capable of multiplication through self-division of their contents. Gemmules differ from true ovules or buds, inasmuch as they are supposed capable of multiplication in their undeveloped state. But this capacity Mr. Darwin thinks is not improbable, from the fact that the blastema within the egg has been known to divide and to originate two embryos; and the spore of a sea-weed was seen to divide itself, and each part to germinate. An atom of small-pox, so minute as to be borne by the wind, must multiply many thousand fold in the person it affects; and it is known, also, that a minute portion of the mucous discharge from an animal affected by the rinderpest, if placed in the blood of a healthy ox will affect every particle of the whole mass, so that in forty-eight hours any small particle of that blood will contain sufficient poison to give the disease to another animal, illustrating the rapidity with which organic matter as cells, gemmules, or granules multiplies.

It is by such multiplication of appropriate organic matter that organisms grow from their microscopic starting point to their full size; but it is not mere growth, but growth in conformity to ancestral types, which it is the purpose of Mr. Darwin to explain. He believes this to be caused by every minute part of the parents' body furnishing the material which in its multiplication will form a corresponding part in its offspring; and while this ensures a general resemblance to parental type, there are still many points of differentiation, most of which are better explained by Darwin's hypothesis than by any other; these differentiations are often known to be resemblances to more remote ancestors, which may be explained by the supposition that gemmules have been transmitted through the near ancestors to the said offspring, in whom suitable conditions have excited the gemmules to activity.

Yours, &c., EBORACUM.

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