

divisions", whereby the germ-cells were prepared for their subsequent union in fertilization and the number of chromosomes was kept constant in the species. If it were not for the preparatory reduction the number of nuclear elements or chromosomes would be doubled at each fertilization. By the brilliant work of Platner, Boveri, O. Hertwig, and many others, for animals, of Guignard, Strasburger, and others, for plants, this fact at least seems to be securely established amidst a maze of uncertainties, that in the history of both male and female germ-cells the number of chromosomes is reduced to one-half of the number characteristic of the body-cells of the species.

Another embryological corollary of the cell-doctrine is that development implies cell-formation, or that the first step after fertilization is the cleavage
The Mode of Development. or segmentation of the ovum.

In 1826 Prévost and Dumas had given the first definite description of the cleavage of the frog's egg, showing that it first divides into two cells, then into four, then into eight, and so on; but the full import of the fact was not realized until later. Thus Schwann and Schleiden believed that cells might arise either by the division of a pre-existing mother-cell or by a process of "free cell-formation". In the latter case, as Wilson says, new cells were supposed to crystallize out, as it were, within a formative or nutritive substance, termed the "cytoblastema". "It required many years of research to show that 'free cell-formation' was a myth, though this had been suggested by many of Schwann's immediate followers, and though Virchow had, in 1855, positively maintained the universality of cell-division, contending that every cell is the offspring of a pre-existing parent cell. He summed up his position in the aphorism, *omnis cellula e cellula*."

But Virchow's conclusion required detailed corroboration, and this was afforded by the early studies on ovum-segmentation and tissue-formation (histogenesis) associated with the names of Kölliker, Reichert, Remak, and many others.

Moreover, in combination with the facts beginning to