

Chapter IX.

Cell and Protoplasm.

The Early Microscopists—Bichat's Step—The Cell-theory—Corroboration of the Cell-theory—Criticism of the Cell-theory—Modern Analysis of the Cell—Cell-division—The Cell-cycle—Structure of the Cell-substance—Protoplasm—Anabolism and Katabolism—Conception of Ultimate Vital Organization.

Harvey made his minuter observations with the aid of a simple lens such as every field-botanist now carries in his pocket, and one must admit that without some better instrument the analysis of structure could not have advanced far beyond what Harvey achieved. The better instrument, which opened up a new world, was the compound microscope, invented about 1600 by Hans and Zacharias Jansen, and rapidly improved by other workers. In the seventeenth century it was used to good purpose by a number of enthusiastic observers who revealed minutiae of structure hitherto unsuspected. Malpighi in Italy, Leeuwenhoek and Swammerdam in Holland, Hook and Grew in England, were among the most notable of these early histologists.

When we consult the works of the early microscopists we cannot help feeling that they often played with their new scientific toy, just as we often play with stains and microtomes. They magnified without purpose, and accumulated descriptions and figures of what are called "interesting objects" or "microscopic curiosities". The play-period in science as well as in life may be essential as an apprenticeship to serious work; but it must be allowed that there is no direct gain in magnifying an object a thousand times, or staining it with three colours, *unless* the magnifying and the staining help us to understand the object better, or keep us from misunderstanding it.

Without any depreciation of the keen vision of Leeuwenhoek or Swammerdam and their contemporaries,