(1650-1723), whose collection of antiquities was afterwards bequeathed to Oxford University. Spon brought back many valuable treasures, coins, inscriptions and manuscripts, and in later years published various important works on archaeology, notably his *Voyage d' Italie, de Dahnatie, de Grèce et du Levant* and a *Histoire de la république de Genève* (1680).

**SPONGES.** The Sponges or Porifera form a somewhat isolated phylum (or principal subdivision) of the animal king­dom. This phylum includes an immense number of marine and fresh-water organisms, all of which agree amongst them­selves in possessing a combination of important structural characters which is not found in any other animals. Though the phylum is a very large one yet almost the only examples with which the name "sponge ” is popularly associated arc the common bath sponges (species of the genera *Euspongia,* and *Hippospongid),* which are amongst the most highly organized and least typical members of the group.

The history of the group begins with Aristotle, who recognized several different kinds of sponge, some of which were used by the Greek warriors for padding their helmets. Owing, however, to the permanently fixed character, irregular growth and feeble power of movement in the adult organism, it was not until the advent of microscopical research that it was definitely proved that the sponges are animals and not plants. Indeed our scientific knowledge of the group can scarcely be said to begin much before the middle of the 19th century, when the classical researches of R. E. Grant, J. E. Gray, H. J. Carter and J. S. Bowerbank laid the foundations of modern spongology. It very soon became evident that the group is one which illustrates with remarkable clearness and beauty those laws of organic evolution which were beginning to attract so much attention from zoologists, a fact. which found abundant recognition in Ernst Haeckel’s epoch-making work on the Calcareous Sponges published in 1872. This was followed by a series of remark­able researches by F. E. Schulze on the minute anatomy, histology and embryology of the group, which have served as a pattern to all subsequent investigators. In more recent years our knowledge of the sponges has advanced very rapidly, especially as the result of the great series of scientific exploring expeditions inaugurated by the voyage of H.M.S. “ Challenger," The large collection made by the "Challenger ” expedition alone, necessitated a complete reorganization of our systematic knowledge of the phylum, and afforded the foundation upon which our present system of classification has been built up. There is perhaps no great group of the animal kingdom in the study of which greater advance has been made in the last twenty years. It is impossible in the space at our disposal to do justice to the numerous valuable memoirs which have appeared during this period, but reference to the more important works of recent investigators will be found in the bibliography at the end of this article, while for a comprehensive account of the whole subject the reader should refer especially to Professor E. A. Minchin’s article in Sir E. Ray Lankester’s *Treatise on Zoology.*

*General Characters of the Phylmn.—*The sponges are all aquatic organisms, and for the most part marine. They vary in size from minute solitary individuals, scarcely visible to the naked eye, up to great compound masses several feet in circumference, and in form from almost complete shapelessness to the most exquisite and perfect symmetry. The indefiniteness of shape and size which characterizes the vast majority of the group is due to the power of budding, which is almost universal amongst them, whereby extremely complex colonies are built up in which it is usually impossible to determine the limits of the individual zooids or persons, while very frequently, by a process of integration, individuals of a higher order are produced which again form colonies by budding (fig. 2).

The entire body of the sponge is penetrated by a more or less complicated canal-system, beginning with numerous in­halant pores, scattered over the general surface or collected in special pore-areas, and ending in one or several larger apertures, the vents or oscula, situated usually on the uppermost portions of the sponge (fig. 8). If the living animal be kept under observation it will be seen that a stream of water is ejected with considerable force from the vents, carrying with it minute particles in suspension. At the same time numerous smaller streams enter the canal system through the inhalant pores, bringing with them the minute particles of organic matter upon which the sponge feeds and the oxygen which it requires for respiration. This stream of water may be temporarily inter­rupted by the closure of the pores and vents, to be resumed apparently at will. It is maintained by the activity of certain cells, known as collared cells or choanocytes (fig. 35, *g*, fig. 36), which line the walls of the canal system either throughout their entire extent or in certain regions only. These cells bear an extraordinarily close resemblance to the choanofìagellate Protozoa or collared Monads. Each is provided with a filmy protoplasmic collar and a long whip-like flagellum, and the movements of the latter drive the water out of the canal-system through the vents and thus keep up the circulation. In all but the simplest sponges the collared cells are confined to certain portions of the canal system known as flagellated chambers (fig. 9), the size, form and arrangement of which vary greatly in different types. That part of the canal-system which is not lined by collared cells is covered with a flattened pavement-epithelium (fig. 34, 1), and so also is the outer surface of the sponge. The space between the various branches of the canal-system is occupied by a gelatinous ground-substanee (meso­gloea) in which amoeboid and connective-tissue cells are em­bedded (fig. 34, 3, 4, 5; fig. 35, *a),* and in which in most cases a well-developed skeleton is secreted by special cells known as scleroblasts. This skeleton (figs. 24-32, &c.) supports the extremely soft tissues of which the body is composed, and con­sists either of mineral spicules (carbonate of lime or silica) or of homy fibres (spongin), or of a combination of siliceous spicules with spongin. In many cases the proper skeleton is more or less completely replaced by sand.

The question as to how far the cell-layers of the sponge body correspond to the “ germinal layers ” usually recognizable in other multicellular animals is an extremely difficult one and not yet by any means settled. It has until recently been generally sup­posed that the flattened epithelium which covers the outer surface of the sponge, together with part of that which lines the canal-system, is ectodermal, while the collared cells and the remainder of the flattened epithelium lining the canal-system are endodermal, and the term mesoderm has been frequently applied to the middle gelatinous layer. Recent embryological research, however, makes it extremely doubtful whether this view is justifiable, and whether indeed the germ-layers of typical Metazoa can be identified at all in the Porifera. Embryological research, moreover, tends to show that the primitive gastral epithelium (of collared cells) is in most sponges completely replaced, except in the flagellated chambers, by an invasion of the dermal epithelium (composed of flat pavement-cells).

Sexual reproduction, by means of ova and spermatozoa, is probably universal throughout the group. The segmentation of the ovum gives rise to the free-swimming ciliated larva (figs. 38, *e,* 39) in the form of a hollow “ amphiblastula ” or of a solid “ parenchymula." This larva becomes attached and, by means of a more or less complex metamorphosis, gives rise to the young sponge. During the metamorphosis the outer, ciliated or flagellated cells of the larva take up their position in the interior of the body and give rise to the collared cells of the adult ; while the inner cells (of the parenchymula) migrate outwards and form the superficial epithelium, so that the position of the so-called “ ectoderm ,, and “ endoderm ” is completely reversed in the adult as compared with the larva.

A sexual reproduction is effected by budding, and the buds may either remain attached to the parent and form colonies or become detached and form entirely separate individuals.

*Types of Structure.—*We may illustrate our account of the general characters of the group by a brief description of the anatomy of three widely divergent types, selected as being fairly representative of the entire group, viz. *Leucosoleτzia, Plakina* and *Euspongia.*

*Leucosolenia.—*The genus *Leucosolenia* includes a number of calcareous sponges of very simple structure, and thus forms a suitable starting-point for our studies. Imagine a minute, thin-walled sac (fig. 1), attached at the lower end to some rock or seaweed, and enclosing a spacious cavity in its interior. This cavity is the gastral or digestive cavity, and it opens to the exterior