Remarkable Biologists

Following on from the success of his two previous books, *Remarkable Mathematicians* and *Remarkable Physicists*, Ioan James now profiles thirty-eight remarkable biologists from the last 400 years. The emphasis is on their varied life stories, not on the details of their achievements, but when read in sequence their biographies, which are organised chronologically, convey in human terms something of the way in which biology has developed over the years. Scientific and biological detail is kept to a minimum, inviting any reader interested in biology to follow this easy path through the subject's modern development.

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Preface

This book is intended for those who would like to read something, but not too much, about the life stories of some of the most remarkable biologists born in the last four hundred years. Biology is a many-sided subject and I interpret the term biologist quite loosely. I begin in the seventeenth century, and end in the twenty-first, but exclude living people as a matter of principle. There are four or five subjects in each of nine chapters, making thirty-eight profiles altogether. The emphasis is mainly on their varied life stories, less on the details of their achievements. The mini-biographies are arranged chronologically by date of birth, so that when read in sequence they convey in human terms something of the way in which the discipline developed. It has not been easy to select a limited number of individuals from far more possibilities, but I mainly choose those for whom a full-scale biography exists. The emphasis is on variety, certainly not on making a list of the most important biologists of the past four centuries. The subjects I have chosen come from ten different countries. Some of them advanced the subject through their research or scholarship, others found some aspect of biology fascinating and studied it from sheer pleasure.

Prologue

Biology is the study of living organisms. More than any other branch of science it has enjoyed a broad appeal, throughout the ages. We all want to know something about the plants and animals which inhabit the natural world, or have done so in the past. We try and identify the birds and other creatures we see around us. We find that as well as the macrocosm of creatures visible to the naked eye there is a microcosm of bacteria, protozoa and other tiny organisms, only visible under the microscope, and that some of these cause disease. All this is common knowledge but specialists in the field, and a host of enthusiastic amateurs, know far more. The various branches of biological science complicate any account of the development of the subject. Nordenskiold (1929) has given an overview but each branch has its own distinctive history and its own culture.

Biology grew out of natural history (which is not history in the modern sense of the word: natural science is a more satisfactory alternative). Pliny the Elder (ca. 22–78) compiled a comprehensive and well-organised guide to the huge amount of information about the wonders of nature that was available in antiquity. He called this *Historia naturalis*, hence the term natural history; practitioners are called *naturalists*. Pliny drew on the work of his Greek predecessors, such as Aristotle and his disciple Theophrastus. Many copies of the *Historia naturalis* were made during the Middle Ages; the first printed edition appeared in 1469, and many others appeared later. Translations were made of the three zoological books of Aristotle and the two botanical books of Theophrastus, but scholars began to believe that it would be better to study animals and plants directly than by reference to these ancient sources. One of the last, and perhaps the greatest, of these encyclopaedic naturalists in the tradition of Pliny was Conrad Gessner (1516–1565), of Zurich, who died of the plague before his projected *Historia plantarum* was written, but whose *Historia animalium*, which appeared in 1551–1558, is regarded as the beginning of modern zoology.

Pliny's near contemporary Dioscorides (ca. 40–80) wrote about the importance of understanding the natural world in light of its medicinal efficacy, describing approximately 550 Mediterranean plants which had uses in medicine. In the sixteenth century natural history began to form part of the medical curriculum at universities, which often maintained a botanical or physic garden where medical students could be shown plants with medicinal uses. The herbarium (a collection of dried plants) was also used

to demonstrate the different kinds of plants. Professors of medicinal botany sometimes took the students on field trips in the summer months. Another development was the formation of cabinets of curiosities, some of which developed into museums. There was a market for books on natural history, often with illustrations, but only a few of the artists who provided these were naturalists themselves. In the seventeenth century the invention of the microscope opened up a new and completely unexpected world. That the smallest drop of water contained countless living creatures was beyond the imagination. It also made it possible to examine the detailed structure of parts of the human body.

The seventeenth century was also the age of the early voyages of exploration. Travellers from England, France, Holland, Portugal, Russia and Spain began to explore the more accessible parts of the world, sometimes by land but usually by sea. Their main purpose was commercial and strategic, rather than scientific. The discovery of the New World at the end of the fifteenth century was followed by a stream of plants and animals unlike those which were already familiar to Europeans. Although few naturalists crossed the Atlantic themselves specimens were collected on their behalf and brought to Europe. Clusius, for one, formed a famous collection of such material at the University of Leiden. As further voyages of exploration were sent out, it became more usual for a naturalist to be taken along, to make observations and to collect interesting material; someone who was medically qualified might fulfil this role. On scientific voyages there was usually a draughtsman on board, whose work might be used to illustrate the published account of the voyage, if one was prepared. Once regular shipping routes were established, as they were to Latin America, it became easier for naturalists to visit the places from which they had been receiving specimens, if they could afford to do so. Those who wished to travel could usually defray their expenses by collecting and importing material which could be sold to naturalists at home.

The great voyages of the latter part of the seventeenth century were usually primarily for a specific objective, for example to search for a north-west passage into the Pacific Ocean or to find the *terra australis incognita*, the continent that since classical times had been thought necessary to balance the land mass in the northern hemisphere. Scientific programmes were usually secondary to the strategic concerns of governments in Britain, France, Russia and Spain. There were political problems which made international collaboration often hard to achieve. The Dutch made it difficult

to reach the Pacific via the Cape of Good Hope, while Spain guarded entry around Cape Horn via the Straits of Magellan.

For a number of reasons voyages of discovery might be connected to what might loosely be called scientific expeditions, pioneering examples of which were sponsored by the Académie Royale des Sciences in the eighteenth century, notably the expeditions to Lapland and Peru to settle the question as to whether or not the Earth was flattened at the poles. One of the most celebrated voyages was that of Louis Antoine de Bougainville, who had founded a settlement on the Falkland Islands on an earlier voyage in 1764. He returned two years later, accompanied by the able naturalist Philibert Commerson (1727–1773), reached Tahiti through the Straits of Magellan, and went on to Samoa, the New Hebrides, the Moluccas, Java and Mauritius. From there the expedition returned to France, after having been away three years, while Commerson was left to explore Mauritius and Madagascar before returning ill to Mauritius, where he died. Commerson collected over 3000 new species which were added to the collections of the Jardin du Roi in Paris; after traversing most of the Pacific rim the expedition foundered on the reef of Vanikoro, off the Santa Cruz Islands, in early 1788. At about the same time the Royal Society of London sought information from voyagers about ethnography and natural history on voyages sponsored by the Royal Navy. Cook's voyages prompted French and Spanish competition, which in turn prompted the Admiralty to send out further expeditions with frankly strategic objectives. The Spaniards invested a great deal of money in botanical expeditions over the last few decades of the century but refused to publish what was discovered, and the Russians also were secretive.

During the nineteenth century the discoveries of science increasingly came into conflict with religious beliefs. Geologists had long believed that the Earth must be far older than stated in the Bible. Fossils were collected and examined. Some appeared to be the remains of organisms which no longer existed; what did this mean? How did it come about that fossils of marine organisms could be found at high altitudes? Instead of there being one act of creation, the idea that there might have been a series of separate acts of creation gained ground. One theory was that the history of the Earth had been marked by great catastrophes, of a scope and intensity never witnessed by man, which wiped out large portions of the animal world. These were then replaced by other forms of life in another act of creation. Those who held this view were known as catastrophists, as distinct from the

uniformitarians, who maintained that the processes at work in historical times, which produced such features as mountain ranges, volcanoes and glaciers, could be taken as a guide to what might have happened long ago.

There were also different theories as to how the natural world came about. The almost unlimited time required by the geologists for the development of the surface of the Earth made the biologists think again, and various evolutionary theories were proposed. Although the basic idea of evolution was widely accepted most scientists believed, well into the nineteenth century, that the natural world had been made by a purposeful Creator in successive independent creations. Although the general principle of the evolution of species was accepted by most biologists, there was a tendency to follow Lamarck and believe in the inheritance of acquired characteristics. This was the situation when Darwin, and independently Wallace, presented the case for natural selection being the main driving force for evolution. Both Darwin and Wallace were unaware that the Austrian monk Gregor Mendel was elucidating the laws of genetics which provided an essential ingredient of the theory of natural selection. For a convincing theory of evolution some explanation of the mechanism was required. Genetics provided this and the idea emerged that genes are the keys to the situation. Today there are still clashes between different schools of thought in this area.

Most branches of science experienced exponential growth in the twentieth century and biology is no exception. New branches of the discipline developed, of which molecular biology is an important example. The determination of the structure of DNA by Crick and Watson led to a better understanding of some of the fundamental problems of biology but others remain. Evolutionary biology still provokes controversy, as does eugenics. Conservation is another area where biologists play a leading role. In the final chapters I have included some comparatively short profiles to illustrate at least some aspects of this variety of activity.