

show the processes and steps by which species are formed, and the causes that govern their differentiation and distribution; in brief, ignoring most that is beautiful and interesting in nature, including the great truths that enable us to understand the operations and laws of nature, for the sake of dwelling eternally on details that ought to form merely a part of the foundation for a study of nature.

The evolution of these one-sided biologists is not hard to trace. Early naturalists, such as Linnæus and Buffon, knew little of the internal structure of animals and plants; their classifications, therefore, were based chiefly on external characters, and were correspondingly crude. Cuvier was first to demonstrate the importance of anatomical knowledge in arranging animals according to their natural affinities, but his studies were confined to what is now called "gross anatomy," or the structure of such parts and organs as are visible to the naked eye.

The great improvement made in the microscope in the years 1830-1832 — at which time the spherical errors that had previously rendered its use unsatisfactory were overcome by the proper adjustment of achromatic lenses — paved the way for the discoveries in embryology and the minute structure of the tissues that made illustrious the names of von Baer, Schleiden, Schwann, and a host of others. The revelations that followed created a profound sensation among the naturalists of the time, and, as the microscope became more and more perfect, new paths were opened to the investigator, and the fascination attending its use grew. The increased demand for good instruments stimulated the invention and perfection of high-power lenses and of a multitude of accessories, the use of which, in turn, led to improved methods of treating tissues and to the discovery of bacteria and the various pathogenic micrococci of fermentation and disease. A knowledge of microscopic technic became, and justly, too, a necessary qualification in the way of preliminary training for those seeking to become biologists.

The transition from the old school to the new was but a step, and had been led up to by the course of events. The older systematic naturalists rapidly died off while still appalled by the wonderful discoveries of the microscopists; the professorships in the colleges and universities (which, at the same time, were rapidly increasing in number) were filled by young men ardent in the use of the microscope, and each anxious to excel his colleague in skill and dexterity of manipulation and in the discovery of some new form of cell or new property of protoplasm.

But one result could follow the continuance of this state of affairs, namely, the obliteration of the naturalist from the face of the earth — a result that at the present moment is well-nigh attained, for, if there is an "all-round naturalist" alive to-day, his existence is due to accident or poverty. Poverty has kept a few lovers of nature away from college, and by this seeming misfortune they have escaped the fate that would have overtaken them had they possessed the means of placing themselves under our modern teachers of biology. These teachers have deflected into other channels many a born naturalist and are responsible for the perversion of the science of biology. While deluding themselves with an exaggerated notion of the supreme importance of their methods, they have advanced no further than the architect who rests content with his analysis of brick, mortar, and nails without aspiring to erect the edifice for which these materials are necessary.

In trying to reconstruct a general naturalist at the present day, I would rather have the farmer's boy who knows the plants and animals of his own home than the highest-graduate in biology of our leading university. The enthusiastic boy, whose love for nature prompts him to collect the birds, insects, or plants within reach, can be easily induced to take up the study of other groups, and thus become a local "faunal naturalist." After acquainting himself with the home fauna and flora, he may develop into a general naturalist if removed to another locality. The chief disadvantage in manufacturing naturalists in this way is that they lack the education possessed by college-bred men — a want sorely felt in after years.

To be well equipped for his work, a naturalist or biologist needs a college education; he needs laboratory instruction in modern