the war, Wilson's *American Ornithology* provided the inspiration for a series of similar illustrated volumes depicting American flora and fauna, written by American scientists and published by American presses.

Wilson's achievements as well as his foibles are ably chronicled in two modern biographies by Cantwell and Hunter, although there are still several periods where his movements remain obscure. Hunter also reproduces the extant correspondence. Burtt and Peterson provide a recent assessment of Wilson's scientific accomplishment, while Allen, Blum, Greene, and Porter do a thorough job of placing his life and work into broader context.

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Mark V. Barrow Jr.

SEE ALSO

Ornithology

Wilson, Edmund Beecher (1856–1839)

Leader in American biology. Wilson was born in Geneva, Illinois, the son of Isaac G. Wilson, a lawyer who became circuit court judge and later chief justice of Chicago's Appellate Court, and Caroline Clarke, a descendant of a Mayflower voyager. After a year teaching a one-room school, he resolved to continue his education. Influenced by his cousin Samuel Clarke, he attended Antioch College (1873–1874), Yale University's Sheffield Scientific School (1875–1878) where he received a Ph.B. degree, then on to Johns Hopkins University for graduate work with William Keith Brooks. With the help of fellowships and assistantships, Wilson entered the world of biology and received his Ph.D. in 1881 for embryological study of the coelenterate *Renilla.*

After one more year at Hopkins as Brooks's assistant, Wilson traveled for a year to Cambridge, Leipzig, and settled at the Stazione Zoologica in Naples. In part because of his love for music and culture, expressed in his serious cello playing, the young Wilson became a good friend of the Stazione's director Anton Dohrn, who urged Wilson to remain in Naples to continue his studies. Yet, Wilson felt obliged to return to the United States, where he taught for a year at Williams College to replace his cousin Samuel Clarke while the latter took his own tour to Europe. Wilson was then given a lectureship at the Massachusetts Institute of Technology, where he worked on a new textbook on *General Biology* with fellow Hopkins graduate William Sedgwick. Finally, Wilson received a "real" position at Bryn Mawr College in 1885, as head of the biology program. He taught there until Henry Fairfield Osborn hired him at Columbia University in 1891, where he remained until he retired. As a committed teacher, Wilson gained his students' respect and affection. He introduced them to the basic concepts and theories in biology, but also to research. For Wilson, the driving question concerned the way in which heredity is reflected in the developmental process. To what extent is the developing embryo directed by its own internal (and largely inherited) conditions, and to what extent by external, environmental factors? His first fascination with biology began as an undergraduate when he encountered Harvard zoologist Edward Laurens Mark's careful study of the details of early cell division. Wilson began to explore with meticulous care the precise nature of cell division and cell growth, asking what each part of the nucleus and cytoplasm do at each stage. Comparing his results with studies of cell lineage in other species, he became a central figure in the major debates of the day about the extent to which the cell divisions are determinate or indeterminate of what occurs in later developmental stages.

Exploring a variety of species, Wilson found the polychaetous worm *Nereis* particularly useful for showing determinacy and regularity of cleavage pattern. Yet,

the evidence did not fit with a more fully mosaic view, like Wilhelm Roux's, which held that each cell division divides the material into differentiated pieces which act like mosaic tiles in making up the whole while retaining their own individual characters. This view held that cell divisions, therefore, involve carrying out preset steps and serve as a sort of preformation. Embryos are more complex than that, Wilson felt, and they are capable of responding to changing factors in their environment in ways that allow much more regulation, perhaps even regulation by the whole organism as Hans Driesch had suggested.

Wilson continued to pursue the same set of questions, searching for better answers by seeking more reliable and varied approaches. Various experimental manipulations provided new data for Wilson and the community of experimental embryologists and cytologists. It became clear that the subcellular parts, such as spindle fibers, centrosomes, and chromosomes, pass through regular patterns of change that correspond to predictable stages of cell division. This suggested a correlation, the study of which took him deeper into the cell nucleus and back toward heredity, toward chromosomes, and eventually to a Mendelian interpretation of heredity, as laid out in an impressive series of articles.

Most of the key pieces of what made up the Mendelian-chromosome theory of heredity and development came from Wilson, his students, or those closely associated with him. Although Nettie Marie Stevens and Thomas Hunt Morgan are the most famous contributors, there were many others. Wilson inspired them to take up a wide variety of studies of the cell, heredity, and development. Through his influence as a teacher, a scholar, and a leader at Bryn Mawr, Columbia, and at the Marine Biological Laboratory in Woods Hole, Massachusetts, where he spent most of his summers, Wilson taught generations of students to love and respect science. His leadership in most of the major scientific organizations reinforced this message, and the excellence of his own research provided a fine example. He also taught that scientists need not be single-mindedly dedicated to their science. Music was also central in his life—both in his own performance and through the commitment of his cellist daughter Nancy Wilson. As one famous contemporary musician reported, Wilson was "the foremost non-professional player in New York" (Muller, p. 166).

Wilson stands out among early American biologists as an outstanding scientist, a strong leader, and a fine man. His work in cytology led to his encyclopedic textbook *The Cell in Development and Inheritance* in 1896, which was revised into further editions in 1900 and 1925. That classic work, still cited by modern cell biologists, reflects Wilson's attention to detail and his grasp of the central theoretical and methodological issues of the day. As his friend and colleague Thomas Hunt Morgan wrote of Wilson, "It is given to few men to exert so great an influence in their chosen field of scientific research and also to attract so many friends over a much wider range of interest. The beauty of Wilson's workmanship and the balanced judgments of his decisions are two of his outstanding accomplishments" (Morgan, 1939, p. 258).

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Jane Maienschein

Winthrop, John, Jr. (1605/06–1676)

Born in England, he was the first Englishman permanently resident in North America to engage in the systematic study of nature. Winthrop was the son of the first governor of the Massachusetts Bay Colony and was himself the first governor of Connecticut.

Although his close ties to England and English culture make it more nearly correct to classify him as an English natural philosopher than as an American scientist, his position in New England did much to determine