EVOLUTION

The First Four Billion Years

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Lamarck proposed that animals were induced to develop new habits when they were confronted with changing or new environments. Changes in habits inevitably led to certain organs being used more and other organs being used less, thereby strengthening the former and weakening the latter. Differences thus acquired were passed on to the next generation, albeit too gradually to be apparent on a human timescale. Over great periods of time, however, this resulted in significant organic change. Lamarck was confident that the distinctive features of such diverse creatures as giraffes, moles, storks, and snakes could be understood as the cumulative result of the inheritance of characters acquired because of long-maintained habits. Although the basic idea of "the inheritance of acquired characters" was not novel with him, he stands out as the first scientist to argue at length that the operation of this process on a geological timescale could produce species change.

It was not until near the end of the nineteenth century, well after Charles Darwin had advanced his own theory of evolution, that the idea of the inheritance of acquired characteristics, or "use-inheritance," came to be widely regarded as the "Lamarckian" explanation of species change in contrast to Darwin's idea of evolution by natural selection. This took place even though Lamarck's ideas about use and disuse constituted just one part of his theorizing and Darwin himself strongly endorsed use-inheritance as a mechanism seconding natural selection in the evolutionary process. The first serious challenge to the idea of use-inheritance came from German biologist August Weismann in the 1880s. Although the idea persisted into the twentieth century, it became increasingly discredited when it failed to gain experimental confirmation and the empirical evidence typically cited in its support was interpreted as being amenable to other explanations.

Lamarck left his mark on science through his contributions to botanical and especially zoological systematics, his pioneering work in invertebrate paleontology, and his evolutionary theorizing. Although he is primarily remembered today for an idea that biologists no longer accept—the idea of the inheritance of acquired characteristics—he nonetheless stands out in the history of biology as the first scientist to set forth a comprehensive theory of organic evolution.

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—*R.W.B.*

Lande, Russell (b. 1951)

Russell Lande is widely recognized as the architect of modern theories of phenotypic evolution and as an innovator in conservation biology. Born in 1951 in Jackson, Mississippi, Lande spent the formative years of his youth in Shreveport, Louisiana; Roswell, New Mexico; and Seal Beach, California. The son of a biology teacher and a petroleum geologist, he explored the swamps of Louisiana and body surfed on the beaches of southern California. He played Little League and bred hooded rats as a student in grammar school, and he was a member of math and honor societies in high school.

Lande's interests in ecology were awakened when he was an undergraduate at the University of California at Irvine. A talented student in mathematics and the physical sciences, Lande looked for opportunities to take a quantitative approach in the biological sciences. That opportunity was provided in a weekly reading club organized by graduate students Ted Case and Michael Gilpin. Their influence encouraged Lande to apply to graduate school at the University of Chicago and to work with professors Richard Levins and Richard C. Lewontin, eminent practitioners of the modeling approach in ecology and evolutionary biology. Shortly after his arrival at Chicago, Levins and Lewontin moved to Harvard. Lande followed suit.

As a graduate student at Harvard, Lande focused on developing theory for the inheritance of quantitative characters and using it to model phenotypic evolution. A chance remark by Lewontin helped set him on this course. While lecturing on Mendelism, Lewontin turned from the chalkboard and quipped, "Of course all ecologically important characters are quantitative, polygenic traits." Three papers (1976a, 1976b, 1977) that are now classics in the fields of quantitative genetics and phenotypic evolution constituted his doctoral thesis.

Lande continued to develop his novel approach to phenotypic evolution as a postdoctoral student with James Crow at the University of Wisconsin at Madison. He also had regular conversations with Sewall Wright, then retired from the University of Chicago and living in Madison. When Lande showed Wright the draft of his 1979 paper, another classic, Wright said that he did not care for the approach because it did not model the frequencies of the genes that underlay the quantitative traits. A year later, Wright volunteered that he might have been hasty in his judgment.

Lande's development of quantitative genetic theory continued when he joined the faculty at the University of Chicago. During his Chicago period, Lande applied his framework to the evolution of life-history characters, sexual dimorphism and sexually selected characters, the measurement of phenotypic selection, phenotypic plasticity, and many other problems in phenotypic

evolution. Each of these contributions stands out because novel theoretical formulations are combined with insightful literature reviews and applications to actual data.

Beginning in the 1980s, Lande's interests shifted to conservation biology, as he took the lead in characterizing the demographic plight of the Northern Spotted Owl by using a combination of classical, modern, and original demographic theory. During this ongoing period, Lande joined the faculty at the University of Oregon and later moved to the University of California at San Diego. Lande is currently a Royal Society Research Professor at Imperial College, London.

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—*S.J.A.*

Leakey, Louis Seymour Bazett (1903–1972)

Louis (pronounced Lewis) S. B. Leakey, the son of an English missionary to Kenya in East Africa, was born at a church mission station at Kabete, northwest of Nairobi in Kikuyu country. It was the policy of the Church Missionary Society to rotate its missionaries back to England every fourth year so that they would not forget their English roots. The Leakeys were brought back in 1904 and stayed for two years, returning to Kenya in 1906. Their next English sojourn was between 1910 and 1913, at which time Louis began formal schooling. In between those times, they lived at the mission station at Kabete. There young Louis joined a peer group of Kikuyu boys and became fluent in their language. Adopted into the group, he was formally initiated as a Kikuyu. Although he often said that he thought of himself as a Kikuyu, he acted and sounded like a good British colonialist for the rest of his life.

World War I interrupted plans to send him to school in England. When the family returned there in 1919, Leakey was duly sent to a public school in Dorset. The phenomenon referred to in England as a "public" school is really a private institution. With the aid of a governess, he was instructed in mathematics, Latin, and French. Although of a longtime English family, Leakey's father had been born in France, so French was often spoken at the Leakey dinner table. While Louis could speak the language, he evidently did so with a pronounced English accent, as did many of his countrymen.

Leakey entered St. John's College, Cambridge, as a freshman in the autumn of 1922. He asked if he could offer Kikuyu as one of the two modern languages required, and the university turned to authorities in London to ask