

## [Berthold Karl Hölldobler \(1936– \)](#) [1]

By: Dhein, Kelle Keywords: [social insects](#) [2]

Berthold Karl Hölldobler studied social [insects](#) [3] like ants in Europe and the US during the twentieth and early twenty-first century. He focused on the social behavior of ants, the evolutionary origins of social [insects](#) [3], and the way ants use chemicals to communicate with each other. Hölldobler's research reached popular audiences through his co-authored Pulitzer Prize winning book *The Ants* and through an award winning nature documentary called *Ameisen: Die heimliche Weltmacht (Ants: Nature's Secret Power)*. Hölldobler researched reproductive practices in specific ant species and helped explain how reproductive practices influence, and are influenced by, social behaviors.

Hölldobler was born 25 June 1936 to Maria and Karl Hölldobler in Erling-Andechs, Germany. Hölldobler's father was a physician and zoologist who published scholarly articles on ants before being drafted into the German military as a medic during World War II. When Hölldobler was seven, his father returned home from the war on leave and took him on a walk through the surrounding woods. The two overturned rocks along the way, eventually discovering a large colony of carpenter ants. Hölldobler later said that the experience of discovering the ant colony greatly influenced him and his research. By the time he was eleven or twelve, Hölldobler said he was able to name every species of ant in his home region of Bavaria, Germany.

After completing secondary education in 1956, in Marktbreit, West Germany (later unified as Germany), Hölldobler enrolled at the University of Würzburg in Würzburg, West Germany. Hölldobler studied chemistry rather than biology, in part, he said, because those around him claimed there were no jobs for biologists. After taking an introductory course in zoology during his first term, however, Hölldobler decided to study both biology and chemistry. In 1957, Hölldobler met Turid Fenzl, a fellow student at the University of Würzburg working as a scientific illustrator and studying art.

In 1958, Hölldobler attended an academic conference in Bern, Switzerland, where he met Martin Lindauer, a behavioral scientist who had just returned to Europe after studying [bees](#) [4] in Brazil. Hölldobler said he was impressed with Lindauer's work but could not afford to transfer to München, West Germany, where Lindauer worked at the time. Hölldobler remained at the [University of Würzburg](#) [5], completing his doctoral dissertation seven years later, in 1965. Also in 1965, Hölldobler married Fenzl.

In his doctoral dissertation, Hölldobler examined the social and reproductive behavior of male ants of the species *Camponotus herculeanus*, or carpenter ants. Before Hölldobler's dissertation work, ant researchers assumed that male *C. herculeanus* ants were similar to the male ants of most other species. They had minimal social interaction with the colony, short lifespans, and were only produced at the beginning of spring in preparation for mating season. Hölldobler's dissertation research showed that male *C. herculeanus* ants were produced before winter and developed through stages within the nest before leaving in the springtime to mate. Hölldobler also found that male *C. herculeanus* ants shared food with their nestmates during the winter, gradually depleting their own bodies' fat reserves as they neared the spring mating season and the end of their lives. Hölldobler's results indicated that the social and reproductive behaviors of ants intertwine to perpetuate an ant colony's reproductive life cycle.

In 1966, Hölldobler traveled to the University of Frankfurt in Frankfurt, West Germany, to join Lindauer's research team. Hölldobler and the rest of the Lindauer group began studying chemical communication and reproductive behavior in ants. Hölldobler studied why some species of ant feed and care for beetle larvae, which is an early stage of physical development exhibited by many insect species. Through experimentation, Hölldobler inferred that the beetle larvae mimicked the movements of ant larvae and secreted a chemical that attracted adult ants. As a result, adult ants cared for the beetle larvae as if they were ant larvae. Hölldobler's results detailed a previously undescribed way in which parasitic insect species take advantage of the chemical communication system and social reproductive practices of ant colonies. Hölldobler claimed that his time at the University of Frankfurt under the leadership of Lindauer was an intellectually stimulating period in his life during which he formed lifelong friendships.

Hölldobler's position at the University of Frankfurt came with many administrative duties. When Harvard University in Cambridge, Massachusetts, offered Hölldobler a visiting scholar position in 1969, Hölldobler later said he accepted it partly because he believed the new position at [Harvard University](#) [6] would afford him more time to focus on his research. Hölldobler's host at [Harvard University](#) [6] was Edward Osborne Wilson, a biologist interested in using evolutionary theory to explain social behavior. According to Hölldobler, he and Wilson began eating lunch together and talking about their shared interest in social [insects](#) [3]. Hölldobler said he considered his first year at [Harvard University](#) [6] to be so productive that he decided to remain at [Harvard University](#) [6] for a second year.

After completing his second year at [Harvard University](#) [6], Hölldobler returned to the [University of Würzburg](#) [5] for one year in 1971 before accepting a full professorship in the biology department at Harvard University in 1973. While in Massachusetts, Hölldobler and his first wife divorced. In 1980, Hölldobler married Friederike M. Probst, a hotel economist. Meanwhile, Hölldobler continued studying ants at [Harvard University](#) [6] and collaborated with Wilson. The two published research about the evolutionary origins of eusocial [insects](#) [3]. Hölldobler and Wilson defined eusocial [insects](#) [3] as living in colonies composed of overlapping generations in which non-reproductive individuals help raise the offspring of reproductive individuals. In the later 1980s, Hölldobler and Wilson started writing a comprehensive book on ants.

In 1990, Hölldobler and Wilson published their book, titled *The Ants*. The book weighed over seven pounds and won the Pulitzer Prize for general non-fiction in 1991. In *The Ants*, Hölldobler and Wilson synthesized the academic literature on ants into an exhaustive volume. Several chapters of *The Ants* including "The Colony Life Cycle," "Altruism and the Origin of the Worker Caste," and "Queen Numbers and Domination," dealt specifically with the developmental biology, [embryology](#) [7], and reproductive behaviors of ants. In addition to making contemporary scientific findings on ant [embryology](#) [7], developmental biology, and reproductive behavior available to a popular audience, Hölldobler and Wilson also used the data accumulated in *The Ants* to test various theories that aimed to explain ant reproductive practices.

After finishing *The Ants*, Hölldobler returned to Germany in 1990 to chair the behavioral physiology and sociobiology department at the [University of Würzburg](#)<sup>[5]</sup>. Also in 1990, he received the Gottfried-Wilhelm-Leibniz Prize of the German Science Foundation, an award that provided Hölldobler with 3 million deutschemarks to fund his research. While at the University of Würzburg, Hölldobler was a member of the Wissenschaftsrat (German Council of Science and Humanities) from 1996 to 1999, an advisory board headquartered in Cologne, Germany, that makes policy recommendations about science and research to the German government.

One of Hölldobler's projects investigated the reproductive practices and colony lifecycle of *Harpegnathos saltator*, an ant species in southern India called the Indian Jumping Ant. Collaborating with Christian Peeters, another researcher at the [University of Würzburg](#)<sup>[5]</sup>, Hölldobler excavated multiple Indian Jumping Ant colonies in southern India. He and Peeters discovered that, unlike most ant species in which queen ants were the only reproductively active individuals, Indian Jumping Ant colonies often had both [egg](#)<sup>[8]</sup>-laying queen ants and sexually [viable](#)<sup>[9]</sup> [egg](#)<sup>[8]</sup>-laying workers. After analyzing their data, Peeters and Hölldobler hypothesized that sexually [viable](#)<sup>[9]</sup> workers and [egg](#)<sup>[8]</sup>-laying queens cooperated in the Indian Jumping Ant species to establish and preserve new colonies. Indian Jumping Ant colonies required a lot of labor to construct because they were elaborate and protected the ants from annual floods. Peeters and Hölldobler argued that workers became reproductively active as the colony's queen aged and eventually died, because the colony represented too great an investment to abandon after the death of the queen. Instead, multiple [egg](#)<sup>[8]</sup>-laying workers filled the reproductive role of the dead queen, enabling the ants to continue living in the same nest.

In 2004, Hölldobler returned to the US to join the School of Life Sciences at Arizona State University in Tempe, Arizona. Once in Tempe, Hölldobler again collaborated with Wilson to coauthor *The Superorganism*, a book published in 2008. In *The Superorganism*, Hölldobler and Wilson examined insect superorganisms. Hölldobler and Wilson defined superorganisms as an advanced form of eusociality in which the individual organisms making up the superorganism rarely competed for reproductive privileges and developed into castes selected to maximize overall colony efficiency when competing with other colonies for food. Though Hölldobler and Wilson focused on ant species that form superorganisms, they also identified termites and honeybees as [insects](#)<sup>[3]</sup> capable of forming superorganisms. *The Superorganism* won *The New York Times*' Notable Book of the Year award.

Hölldobler published the results of his experimental research for over fifty years, contributing theories about the functions of chemicals in insect communication, the developmental biology of ants, and the reproductive practices of social [insects](#)<sup>[3]</sup>. In addition to publishing over 300 scholarly articles, Hölldobler has also reached a popular audience through his co-authored books, including one with Wilson, *Journey to the Ants: A Story of Scientific Exploration*, and through a documentary film based on his work, *Ants: Nature's Secret Power*. Hölldobler received the John Simon Guggenheim Fellowship, the Benjamin Franklin-Wilhelm von Humboldt Prize of the German-American Academic Council, the Lichtenberg Medal, and the Ernst-Jünger Prize for Entomology.

Into the early decades of the twenty-first century, Hölldobler researched army ants at Arizona State University, where he helped found the Social Insect Research Group and Center for Social Dynamics and Complexity.

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