

# Natural selection, evolution, mutation, variation, heritability, and fitness.

[Science](#), [Biology](#)



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**EVOLUTION IN ACTION** Darwin envisioned natural selection acting so slowly that its effects would be imperceptible in a human lifetime. But in the late 1900s, evolutionary biologists began to detect small but significant changes taking place in a handful of species. In the past decade, many more cases of natural selection have come to light, and scientists now realize that species can adapt quickly to changes in their environment. In fact, they are finding that we humans are unwittingly driving some of the fastest bursts of evolution right now. As greenhouse gases drive up the planet's average temperature, for instance, some species are adapting to the changing climate. In California, University of Toronto biologist Arthur Weis and his colleagues found that a seven-year drought had spurred the evolution of field mustard plants. In 2007, they reported that the plants were now genetically programmed to flower eight days earlier in the spring.

[http://www.pbs.org/wgbh/nova/evolution/ten-great-advances-evolution.](http://www.pbs.org/wgbh/nova/evolution/ten-great-advances-evolution.html)

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fitness. Field mustard. Between 2000 and 2004, southern California had a severe drought. For many plants, including field mustard (a scrawny annual plant with little yellow flowers), a drought means a shorter growing season. A shorter growing season means that plants that flower earlier are more likely to leave seeds than plants that flower later - which are in danger of dying before they've finished reproducing. Since flowering time has a large genetic component, a drought - by favoring plants that flower earlier - could cause an evolutionary shift towards early flowering. Has it? Yes. The beauty of plants is that they make seeds - small packets of genes that can be stored

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for a period. This means that the genes of the past can, in principle, be compared directly with the genes of today. And an experiment in which field mustard plants grown from seeds collected in 1997 and in 2004 were planted together, under controlled conditions, showed clear differences in flowering times: the plants from 2004 flowered significantly earlier.

Moreover, in both years, seeds were collected from two sites, one where the soil is sandy and doesn't hold water well, and the other where the soil stays wet for longer. As you'd expect, plants from the dry site showed a more dramatic shift than plants from the wet site. In the course of just 7 years, then, natural selection caused the plants to evolve an earlier flowering time.

<http://opinionator.blogs.nytimes.com/2008/07/22/a-natural-selection/>

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Evolutionary biologist Shane Wright of the University of Auckland, New Zealand, has shown that species evolve more than twice as fast in tropical zones as in temperate areas. As squid encounter warmer weather, for example, their bodily functions speed up and they reproduce more often, says Wright. As their population explodes, so does their genetic diversity. This, in turn, means more chances for genetic mutations to show up in subsequent generations, specializing creatures to certain waters. Eventually they become so unique that they're different species altogether. In the past, it's taken millions of years for an organism to evolve the genetic differences necessary to be considered a separate species. (The general distinction for a new species is that it cannot, or will not, breed with its parent species.) But lately there has been evidence that plants and animals are changing much faster than that. Take the weed field mustard. After just seven generations

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around California's global warming-related droughts, the mustard flowers earlier than normal, says evolutionary biologist Art Weis of University of California, Irvine. Plants like the resilient field mustard, " may be put in a superior position," in a warming environment, he says. " Some exotic species that now are not quite invasive could be pushed over that threshold to become invasive simply because they're able to keep up with the climate." Invasive plants and animals can destroy an entire ecosystem, however, and many of the most adaptable animals—rats, cockroaches, jellyfish, mosquitoes—are not necessarily the most desirable neighbors. Weedy field mustard will outlast maple trees. Canadian squirrels, breeding sooner because of early springs, will outlast New Hampshire loons that neglected winter migration this year when lakes didn't freeze as normal. Still, nature is nothing if not an innovator, and an explosion of invasive species has beneficial repercussions for some animals. The temperature spike 50 million years ago created an insect boom, and as insects diversified and thrived, bats did the same. This is when many bat species evolved their unique aviation and sonar abilities to locate specific kinds of insects. Read more: <http://www.smithsonianmag.com/science-nature/species.html#ixzz1dXsC8iZI>