

Evolution & Genetics Resources on HHMI BioInteractive

Short Films

Short Film- The Origin of the Species: The Making of a Theory (www.hhmi.org/biointeractive/origin-species-making-theory). Darwin and Wallace's epic voyages independently led to the theory of evolution by natural selection.

Short Film- Got Lactase? The Co-Evolution of Genes and Culture (<http://www.hhmi.org/biointeractive/making-fittest-got-lactase-co-evolution-genes-and-culture>). Human geneticist Spencer Wells, director of the Genographic Project of the National Geographic Society, tracks down the genetic changes associated with the ability to digest lactose as adults.

Short Film- Making of the Fittest: Evolving Switches, Evolving Bodies (<http://www.hhmi.org/biointeractive/making-fittest-evolving-switches-evolving-bodies>) After the end of the last ice age 10,000 years ago, populations of marine stickleback fish became stranded in freshwater lakes dotted throughout the Northern Hemisphere in places like Alaska and British Columbia. These remarkable little fish have adapted and thrive, living permanently in a freshwater environment drastically different than the ocean.

Short Film- The Origin of Species: The Beak of the Finch (<http://www.hhmi.org/biointeractive/origin-species-beak-finch>). Four decades of Rosemary and Peter Grant's research on finch species that live on the Galápagos Islands illuminate how species form and multiply.

Short Film- Making of the Fittest: Natural Selection and Adaptation (www.biointeractive.org/making-fittest-natural-selection-and-adaptation). The rock pocket mouse is a living example of Darwin's process of natural selection. The film features Dr. Michael Nachman, whose work in the field and in the lab has quantified the selective pressure of predators and identified the genes involved in adaptation. In a complete story, from ecosystem to molecules, pocket mice show us how random changes in the genome can take many paths to the same adaptation—a colored coat that hides them from predators.

Short Film- Popped Secret: The Mysterious Origin of Corn (<http://www.hhmi.org/biointeractive/popped-secret-mysterious-origin-corn>). Where did corn come from? Genetic and archaeological data point to what may seem like an unlikely ancestor: a wild Mexican grass called teosinte.

Lectures

Lecture: Genetics of Human Origins and Adaptation, Sarah Tishkoff, PhD, 2011 Holiday Lectures on Science (<http://media.hhmi.org/hl/11Lect2.html>). Sarah Tishkoff discusses the evolutionary history of modern humans based on genetic analysis and lactase persistence as an example of a recent human adaptation.

Interactive Tutorials (Click and Learns)

Click and Learn: Regulation of the Lactase Gene (<http://www.hhmi.org/biointeractive/regulation-lactase-gene>). Lactase persistence results from a mutation that changes how transcription factors interact, thereby affecting gene expression. We viewed a video of Sarah Tishkoff discussing the lactase persistence mutation, and an animation of transcription.

Click and Learn: Explore Your Inner Animals (<http://media.hhmi.org/biointeractive/click/explore-your-inner-animals/>). Explores different anatomical features of the human body and what they reveal about the evolutionary history we share with other organisms, including earlier, long-extinct species. We focused on vision (click on the eye.)

Click and Learn: Genetic Switches (<http://www.hhmi.org/biointeractive/genetic-switches>). Learn how gene switches can control expression of genes in different tissues.

Primary Literature

Copying errors lead to evolution: Celniker et al. 2009, [Unlocking the secrets of the genome](https://doi.org/10.1038/459927a). Nature 459, 927-930 (18 June 2009)

Lactase persistence emerged about 7,500 years ago: Curry, A. 2013. The milk revolution. Nature 500, 20-22.

Three SNPs associated with lactase persistence in Africa: Tishkoff et al. 2006. Convergent adaptation of human lactase persistence in Africa and Europe. Nature Genetics 39, 31-40. doi:10.1038/ng1946

Variations in primate cone photopigment arrangements: Jacobs, G. H. 2009. Evolution of colour vision in mammals. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 364(1531), 2957–2967. doi:10.1098/rstb.2009.0039.

Gene Therapy for red-green color blindness in adult primates. Mancuso et al. 2009. Gene therapy for red–green colour blindness in adult primates. *Nature*, 461, 784-788. doi:10.1038/nature08401

Evolution of feathers. Koschowitz M-C, C. Fischer, M. Sander. 2014. Beyond the rainbow. *Science* 346, 416-418. DOI: 10.1126/science.1258957

Evolution of feathers. C Foth et al. (2014) . New specimen of *Archaeopteryx* provides insights into the evolution of pennaceous feathers. *Nature* 511, 79-82 (2014) doi:10.1038/nature13467.

Dorsal spines in stickleback fish, an example of heterotopy. Hendry, A. 2008. Evolutionary biology: Darwin in the fossils. *Nature* 451, 779-780 (14 February 2008). doi:10.1038/451779a

Evolution of character displacement in Darwin’s finches. Grant, P, and R. Grant. 2006. Evolution of character displacement in Darwin’s Finches. *Science* 313, 224-226: 14 July 2006

Heterometry in Darwin’s finches. Abzhanov et al. 2004. Bmp4 and Morphological Variation of Beaks in Darwin's Finches. *Science* 305, 1462 -1465. DOI: 10.1126/science.1098095

The calmodulin pathway and the evolution of elongated beak morphology in Darwin’s finches. Abzhanov et al. 2006. The calmodulin pathway and evolution of elongated beak morphology in Darwin's finches. *Nature* 442, 563-567(3 August 2006) doi:10.1038/nature04843

The developmental basis of phallus reduction during bird evolution. Herrera et al. 2013. Developmental Basis of Phallus Reduction during Bird Evolution. *Current Biology*, Volume 23, Issue 12, 17 June 2013, Pages R523-R525. doi:10.1016/j.cub.2013.04.062

Frequency of MC1r alleles in one mainland and eight beach mouse subspecies from northern Florida. Hoekstra et al. 2006. A Single Amino Acid Mutation Contributes to Adaptive Beach Mouse Color Pattern, *Science* 313 101-104.

Adaptive evolution of multiple traits through multiple mutations at a single gene. Linnen et al. Adaptive Evolution of Multiple Traits Through Multiple Mutations at a Single Gene. *Science* 2013;339:1312-1316. DOI: 10.1126/science.1233213

Evolution in deer mice. E Pennisi. Field Test Shows Selection Works in Mysterious Ways. *Science* 2013;341:118-118

Animations

Animation: Pocket Mouse Evolution (<http://www.hhmi.org/biointeractive/pocket-mouse-evolution>). This simulation shows the spread of a favorable mutation through a population. Even a small selective advantage can lead to a rapid evolution of a population.

Animation: Pocket Mouse and Predation (<http://www.hhmi.org/biointeractive/pocket-mouse-and-predation>). This animation shows the different visibility of light and dark mice to predators in different environments. The dark morph is more vulnerable on light sandy desert, and the light morph on dark lava rock.