The Making of the Fittest: The Birth and Death of Genes

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Abbreviated Film Guide
Educator Materials

DESCRIPTION

Icefish have a set of stunning adaptations that help them thrive in the icy but food-rich environment of the Antarctic. Both the birth and death of genes have been critical to these adaptations. Dr. Bill Detrich, Dr. Christina Cheng, Dr. Art DeVries, and other scientists have pinpointed the genetic changes that enable icefish to survive without red blood cells and use antifreeze proteins in the ice-cold ocean.

KEY CONCEPTS

- Traits (characteristics) are determined by genes.
- Mutations can result in both the appearance of new genes and the loss of existing genes.
- Changes in the environment where a population lives can change which traits (and therefore genes) are favorable.
- The frequency of an allele in a population can change depending on whether the allele is advantageous, deleterious, or neutral.
- One way that a new gene can arise is when a gene is duplicated and one copy (or both copies) of the gene accumulates mutations, which change the function of the gene.
- One way that a gene can be lost is when one or more mutations accumulate that destroy its function.

PRIOR KNOWLEDGE

Students should

- have a basic understanding of natural selection, evolution, and adaptation;
- know basic genetics, including understanding what a gene is and knowing that mutations, duplications, and deletions are some of the ways in which genes and DNA can change;
- understand that genetic changes can happen randomly; and
- know that genes and the traits that they produce are inherited and that some traits afford organisms a greater chance to survive and reproduce.

KEY REFERENCES

Carroll, Sean B. *The Making of the Fittest: DNA and the Ultimate Forensic Record of Evolution*. New York: W.W.

Norton & Company, 2006. Deng, Cheng, C.-H. Christina Cheng, Hua Ye, Ximiao He, and Liangbiao Chen. "Evolution of an Antifreeze Protein by Neofunctionalization under Escape from Adaptive Conflict." *Proceedings of the National Academy of Sciences* 107, no. 50 (December 14, 2010): 21593–21598.

Matz, Michael. "Fish: Fresh, Not Frozen." *Antarctica: Scientific Journeys from McMurdo to the Pole*. http://www.exploratorium.edu/origins/antarctica/ideas/fish.html