NOVA PBS

TOPIC: Evolution

Media-Rich Lesson Ideas

What Darwin Never Knew

Charles Darwin's radical insights about evolution raised as many questions as they answered. "What Darwin Never Knew" takes a look at breakthroughs in a brand-new science—nicknamed "evo devo"—and offers answers to riddles that Darwin couldn't explain.

WELCOME to NOVA's "Lesson Ideas." This new feature mines NOVA's vast library to bring you a robust selection of interactives, video clips, and lesson plans you can use to make science come alive for your students. Come back each week for a new collection centered on a different topic area.

Subject area covered: Evolution

Feedback
Tell us what you think. Send us your thoughts, questions, comments, and ideas.

INTRODUCE THE PROGRAM & TOPICS
Present the program's overall science or career topics to your students.

UNDERSTAND EVOLUTION
Use these resources to provide background for the lesson ideas suggested in the "Learn the Science" and "Discover Careers" sections.

LEARN THE SCIENCE
Introduce key science topics and concepts with these media-rich resources.

EXAMINE DARWIN'S THEORY OF NATURAL SELECTION
See how Charles Darwin's ideas are the bedrock of our understanding of life on Earth.

EXPLORE "EVO DEVO"
Understand how evolution took place at a genetic level.

DISCOVER CAREERS
See what it's like to work in the field.

RELATED CAREERS
Find out about careers related to evolutionary biology.

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Media-Rich Lesson Ideas

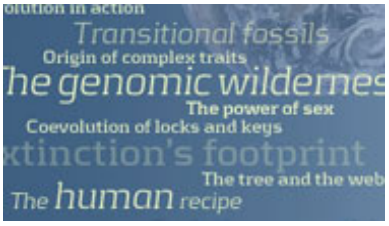
What Darwin Never Knew

Introduce the Program & Topics

UNDERSTAND EVOLUTION

For hundreds of years, scientists have been trying to understand the mysterious process that has given rise to such astounding diversity within species. Explore the progress that's been made in determining why species adapt and change.

What Darwin Never Knew (Video)
Hear how the study of DNA has taken our understanding of how creatures evolve and develop to a level that Darwin could never have dreamed of. (Chapter 6, 8:08 min.)
http://www.pbs.org/wgbh/nova/beta/evolution/darwin-never-knew.html



Ten Great Advances in Evolution (Article)
Read about 10 significant recent advances in evolution studies.
http://www.pbs.org/wgbh/nova/beta/evolution/ten-great-advances-evolution.html

A Brief History of Life (Interactive)
Explore 4.5 billion years of life on Earth, from the earliest bacteria to the first modern humans.
http://www.pbs.org/wgbh/nova/beta/evolution/brief-history-life.html

Genetic Tool Kit (Video)
Understand how one set of genes, shared by almost all animals, makes myriad life forms possible. (4:47 min.)
http://www.pbs.org/wgbh/evolution/library/03/4/l_034_04.html

Learn the Science

EXAMINE DARWIN'S THEORY OF NATURAL SELECTION

One hundred and fifty years ago, Charles Darwin set forth his theory of evolution by natural selection, which became the foundation of our understanding of life on earth. Explore his insights with your students.

What Darwin Never Knew (Video)
Follow the path that led Darwin to his theory of evolution by natural selection, and his masterwork "On the Origin of Species." (Chapters 2-5, 29:48 min.)
http://www.pbs.org/wgbh/nova/beta/evolution/darwin-never-knew.html

Evolving Ideas: How Does Evolution Really Work? (Video)
Understand the process of evolution through natural selection by hearing from scientists who are researching hummingbirds. (6:39 min.)
http://www.pbs.org/wgbh/evolution/library/11/2/e_s_4.html

Darwin's Predictions (Interactive)
See how Darwin's ideas about evolution continue to be confirmed by science today.
http://www.pbs.org/wgbh/nova/beta/evolution/darwins-predictions.html

Darwin: An Origin of Species (Interactive)
Witness for yourself how a new species can evolve as you observe natural selection and adaptive radiation in action in a family of birds called honeycreepers.
http://www.pbs.org/wgbh/evolution/darwin/origin/index.html

Dogs and More Dogs (Lesson)
Play a card game to learn how selective pressures can affect an organism's evolution (i.e. how all dogs are descended from a gray wolf).
http://www.pbs.org/wgbh/nova/teachers/activities/3103_dogs.html

Dogs and More Dogs *(continued)*

Curriculum Connections
Evolution, genes, gene pools, selective pressures, mutation, species, traits, genetic isolation, calculating averages
Standards
Grades 5-8
Standard A: Science as Inquiry: Abilities necessary to do scientific inquiry, Understanding about scientific inquiry
Standard C: Life Science: Reproduction and heredity, Diversity and adaptations of organisms
Math Standards (Grades 6-8): Algebra, Data Analysis and Probability, Communication, Connections, Representation
Grades 9-12
Standard A: Science as Inquiry: Abilities necessary to do scientific inquiry, Understanding about scientific inquiry
Standard C: Life Science: The molecular basis for heredity, Biological evolution
Math Standards: Algebra, Data Analysis and Probability, Communication, Connections, Representation

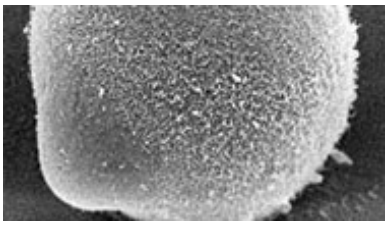
EXTENSION ACTIVITY
All in the Family (Interactive)
Build an evolutionary tree of life by comparing traits of varying organisms.
http://www.pbs.org/wgbh/evolution/change/family/index.html

Curriculum Connections
Species, evolutionary tree, tree of life, anatomical traits, developmental traits, molecular traits, primitive traits, derived traits
Standards
Grades 5-8
Standard A: Science as Inquiry: Abilities necessary to do scientific inquiry, Understanding about scientific inquiry
Standard C: Life Science: Life Science: Reproduction and heredity, Diversity and adaptations of organisms
Grades 9-12
Standard A: Science as Inquiry: Abilities necessary to do scientific inquiry, Understanding about scientific inquiry
Standard C: Life Science: Molecular basis of heredity, Biological evolution

Learn the Science

EXPLORE "EVO DEVO"

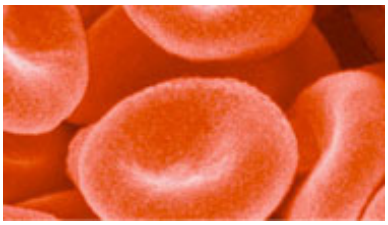
Although Darwin's theory of why species adapt and change has been called "the best idea anyone ever had," it was incomplete. Today, the field of "evo devo," or evolutionary developmental biology, answers the question of how evolution actually took place.



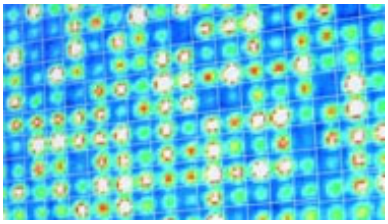
What is Evo Devo? (Article/Interview)
Find out about the new field of science called "evo devo" and some of the groundbreaking discoveries that have been made.
http://www.pbs.org/wgbh/nova/beta/evolution/what-evo-devo.html

Guess the Embryo (Interactive)
Watch four similar-looking embryos develop and see if you can tell what type of organism each will become.
http://www.pbs.org/wgbh/nova/beta/evolution/guess-embryo.html

The Zoo of You (Interactive)
See how closely parts of your body match those in other animals, from sharks to fruit flies.
http://www.pbs.org/wgbh/nova/beta/evolution/zoo-you.html



Gene Switches (Interactive)
See the power of switches—the genes in our genome that turn other genes on and off.
http://www.pbs.org/wgbh/nova/beta/evolution/gene-switches.html



Kitchen DNA (Lesson)
Collect and see your own DNA using a simple solution you can make in your own kitchen.
http://www.pbs.org/wgbh/nova/sciencenow/0302/01-kitchendna.html

Kitchen DNA *(continued)*

Curriculum Connections
DNA, DNA analysis, DNA extraction, kitchen chemistry, pH levels
Standards
Grades 5-8
Standard A: Science as Inquiry: Abilities necessary to do scientific inquiry, Understanding about scientific inquiry
Standard B: Physical Science: Properties and changes of properties in matter
Standard C: Life Science: Structure and function in living systems, Reproduction and heredity
Grades 9-12
Standard A: Science as Inquiry: Abilities necessary to do scientific inquiry, Understanding about scientific inquiry
Standard B: Physical Science: Chemical reactions
Standard C: The cell, The molecular basis of heredity

EXTENSION ACTIVITY
Explore a Stretch of Code (Interactive)
See what researchers see when they look at human genetic code: reveal a switch, a gene, a start codon, and more.
http://www.pbs.org/wgbh/nova/genome/explore.html

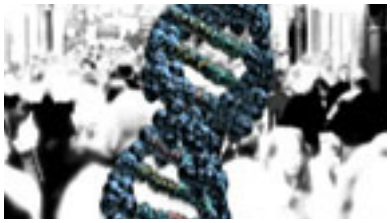
Curriculum Connections
Genetic code, human genome, DNA, chromosomes, switches, codons, introns, exons, code, variation, gene
Standards
Grades 5-8
Standard A: Science as Inquiry: Abilities necessary to do scientific inquiry, Understanding about scientific inquiry
Standard C: Life Science: Reproduction and heredity, Diversity and adaptations of organisms
Grades 9-12
Standard A: Science as Inquiry: Abilities necessary to do scientific inquiry, Understanding about scientific inquiry
Standard C: Life Science: The molecular basis of heredity, Biological evolution

Explore Careers

RELATED CAREERS

Find out more about careers related to evolutionary biology.

The DNA of Human Evolution (Article/Interview)
Read how Katie Pollard, a computational biologist and associate professor of biostatistics at the Gladstone Institutes at the University of California, San Francisco, describes key parts of our DNA that distinguish us from other apes.
http://www.pbs.org/wgbh/nova/beta/evolution/dna-human-evolution.html



Personal Genome Project (Video)
Learn why George Church of Harvard Medical School hopes to recruit 100,000 people and sequence all of their DNA. (3:30 min.)
http://www.pbs.org/wgbh/nova/sciencenow/dispatches/080627.html

Meet the Decoders (Video/Interview)
Listen to video clips and read interviews of three important scientists in the human genome field. (Three videos together total 1:52 min.)
http://www.pbs.org/wgbh/nova/genome/decoders.html

Sequence for Yourself (Lesson/Interactive)
Be a DNA sequencer and determine the order of A's, G's, C's, and T's that make up the human genome.
http://www.pbs.org/wgbh/nova/genome/sequencer.html

Sequence for Yourself *(continued)*

Curriculum Connections
DNA, human genome, genetic code, gene sequence, chromosomes
Standards
Grades 5-8
Standard A: Science as Inquiry: Abilities necessary to do scientific inquiry, Understanding about scientific inquiry
Standard C: Life Science: Reproduction and heredity, Diversity and adaptations of organisms
Grades 9-12
Standard A: Science as Inquiry: Abilities necessary to do scientific inquiry, Understanding about scientific inquiry
Standard C: Life Science: The molecular basis of heredity, Biological evolution

EXTENSION ACTIVITY
Ancient Creatures of the Deep (Lesson)
Be an evolutionary biologist and compare and classify a "living fossil," the coelacanth, in relation to a moray eel and a bull shark.
http://www.pbs.org/wgbh/nova/teachers/activities/3003_fish.html

Curriculum Connections
Living fossils, fish anatomy, organism classification
Standards
Grades 5-8
Standard A: Science as Inquiry: Abilities necessary to do scientific inquiry, Understanding about scientific inquiry
Standard C: Life Science: Structure and function in living systems, Diversity and adaptations of organisms
Grades 9-12
Standard A: Science as Inquiry: Abilities necessary to do scientific inquiry, Understanding about scientific inquiry
Standard C: Life Science: Biological evolution