



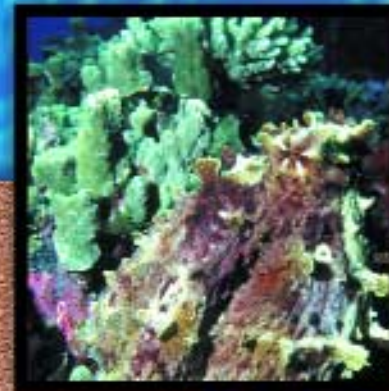
NATURESM

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TRIUMPH OF LIFE

TEACHER'S GUIDE



thirteen
WNET NEW YORK



Dear Friends of NATURE:

Park Foundation is dedicated to education and quality television. We are also deeply concerned about our environment. It is for these reasons that we are pleased to sponsor NATURE, the public television series that reveals the diversity and drama of life on our planet.

NATURE gives teachers and their students the opportunity to learn more about the intriguing behavior and the startling beauty of our world's wildlife. This season's education package offers lessons, activities and research projects to accompany the NATURE mini-series, *Triumph of Life*. The six programs in the mini-series show how life forms have changed throughout time. Over millions of years, many creatures have become extinct. During the same period, others have existed almost unchanged while some have adapted and evolved in order to survive.

In supporting NATURE, our goal is to heighten your students' appreciation and understanding of the world's plant and animal life. We hope that the programs of *Triumph of Life*, together with the lessons in this Guide, will help them look at things from a scientist's point of view.

Please know we are grateful for your efforts.

Trustees
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Park Foundation Inc., P.O. Box 550, Ithaca, New York 14851



Canon U.S.A., Inc.
One Canon Plaza
Lake Success, NY 11042-1113

Dear Educator:

For the eleventh consecutive year Canon U.S.A., Inc. is pleased to be a sponsor of the NATURE series, and bring you this Teacher's Guide.

Canon is a company well known for developing advanced technology products. However, some of our most important research projects have nothing to do with our products. We invest in "future generations" by supporting a wide variety of programs reaching today's children and protecting tomorrow's environment. It is our belief that a successful business should do more than make a profit; it should make a difference as well.

Through our Clean Earth Campaign we work to preserve our natural lands with programs such as "Expedition Into The Parks" through the National Park Foundation. Additionally, our "Cartridge Recycling Program" keeps millions of toner cartridges out of landfills, while our office equipment is designed to use less energy by exceeding the Environmental Protection Agency's ENERGY STAR guidelines. Canon also sponsors the "Canon Envirothon," a nationwide high school curriculum and competition that helps students develop an early sense of environmental responsibility.

We hope this Teacher's Guide provides you with tools to assist your teaching of the world around us. We salute your efforts and deeply respect your commitment to America's "future generations." We are honored to provide you with materials you may wish to use in preparing your students to better understand NATURE.

Sincerely,

Kinya Uchida
President & CEO
Canon U.S.A., Inc.

Please visit our Web site at www.usa.canon.com



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730 Third Avenue
New York, NY 10017-3206

Dear Educator:

Once again TIAA-CREF is delighted to be a national sponsor of NATURE, and to help bring its award-winning educational programs and teaching materials to you and your students.

We hope the accompanying Teacher's Guide will prove stimulating as you and your students participate in NATURE's exciting programs on how living things adapt and thrive in changing environments.

This year, NATURE has prepared an education package to accompany the six-part series, *Triumph of Life*. The Teacher's Guide and poster explore how species have evolved over millions of years into the stunningly diverse life forms on Earth.

For over eighty years, TIAA-CREF has recognized the crucial role of the teacher in our society. We are dedicated to providing pension, investment, and insurance products that help build financial security for those who choose careers in education and research.

TIAA-CREF salutes you and your colleagues for your commitment to educating our youth.

John H. Biggs
Chairman, President and CEO

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William Clay Ford, Jr.
Chairman of the Board
Ford Motor Company
The American Road
P.O. Box 1899
Dearborn, Michigan 48121-1899 USA

Dear Educator:

I am pleased that Ford Motor Company is bringing you this Teacher's Guide for NATURE. Teaching young minds about the environment is a vitally important task. Making the world a better place is an important part of Ford's view of the world, and that includes educating the next generation about society's role in the global ecosystem.

The NATURE series, with its focus on wildlife and natural habitats and their preservation, is an inspiring and exciting way for children to encounter the environment in the classroom. We are proud to be associated with it.

On behalf of all of us at Ford Motor Company, I salute your work and hope you find these NATURE materials a useful tool.

Sincerely,

William Clay Ford, Jr.

For information on vehicles Ford Motor Company has developed to make driving easier on the world around us, call 1-877-ALT-FUEL (1-877-258-3835, Monday-Friday, 8:00 a.m. to 5:00 p.m. EST), or visit our Web site at www.ford.com



INTRODUCTION

Triumph of Life tells the story of evolution — how our planet came to be filled with the diversity of life we see around us, and how the ancient struggle for life is still being fought today. The six programs in the series are “The Four Billion Year War,” “The Mating Game,” “The Eternal Arms Race,” “Winning Teams,” “Brain Power,” and “The Survivors.” *Triumph of Life* shows how living things adapt and use a number of strategies to survive, but that species can become extinct when the environment changes. Lessons in the guide discuss how survival depends on having the resources to meet life’s challenges.

Evolution is a theory that scientists discuss and research for which there is abundant evidence. One of the fundamental concepts of the *National Science Education Standards* for grades 5-8 is that “biological evolution accounts for the diversity of species developed through gradual processes over generations.” We hope you can incorporate these materials into your curriculum using national and local standards.

National Science Education Standards that are most relevant for *Triumph of Life* are Content Standard C for Life Science with grades 5-8: Structure and Function of Living Systems, Reproduction and Heredity, Regulation and Behavior, Populations and Ecosystems, and Diversity and Adaptations of Organisms. The guide lists appropriate standards in the Teacher’s Page for each program.

The *National Science Education Standards* were published by The National Research Council. They can be purchased in book form from the National Academy Press or downloaded from the Web for your personal use. For more information, visit www.nap.edu/readingroom/books/nses/html. For more on standards for grades 5-8, visit www.nap.edu/readingroom/books/nses/html/6d.html.

The Educational Materials

This guide includes a Teacher’s Page and a Student Worksheet (we call it a “Naturalist’s Guide”) for each program in *Triumph of Life*. The Teacher’s Page features an **Overview**, **Objectives**, before and after **Viewing Activities**, **Discussion Questions**, and **Suggested Resources**. **Vocabulary** words are listed on the back cover of the guide.

The Student Worksheets (Naturalist’s Guides) are to be duplicated and distributed in class. These pages include activities that ask students to observe and research the behavior or physical adaptations of animals that are highlighted in the series. They encourage family viewing and contain a number of creative activities.

While these materials encourage home viewing, you may choose to focus on segments of a program in class. If you use this approach, we recommend that you tape and preview the program to find segments that relate to the discussion questions and student worksheet.

Program Scheduling

Programs are scheduled to be broadcast on the dates indicated below. Broadcast dates, however, may vary slightly from area to area. Please check local listings for any scheduling changes.

Program Broadcast Dates

The Four Billion Year War	Jan. 14
The Mating Game.....	Jan. 21
The Eternal Arms Race.....	Jan. 28
Winning Teams.....	Feb. 4
Brain Power.....	Feb. 11
The Survivors.....	Feb. 18

NATURE on the Web

Look for more information about NATURE on the Web at: www.pbs.org or at www.thirteen.org. These lessons (and others) can be found at: www.thirteen.org/nature/teach.html.

wNetSchool is Thirteen/WNET New York’s practical and FREE Web service for K-12 teachers, adult educators, technology coordinators, parents, child-development professionals, and educational practitioners. It features everything from standards-based lesson plans and classroom activities to a multimedia and Internet primer, online courses, links to Thirteen’s educational divisions, and resources and tools to help educators. wNetSchool’s Web address is www.thirteen.org/teach.

Videotaping Rights

You may assign programs to your students for viewing when they are first broadcast, or you have the right to tape the programs and play them for instructional purposes for one year after the original broadcast.

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PROGRAM
overview

Based on fossil evidence, we know that the first life (bacteria) appeared on Earth nearly four billion years ago. Since then, countless plant and animals species have evolved on our planet. Some animals, such as crocodiles, have hardly changed since the age of the dinosaurs. Others, such as birds and mammals, have evolved into highly diverse groups. All living things have a set of instructions that determine their characteristics. These instructions, called genes, are passed from parents to their offspring. The diversity of life on Earth today is the result of natural selection occurring over billions of years.

THEME: All living things fight to survive and breed, seizing opportunities wherever they arise.

NATURE
Teacher's
Guide

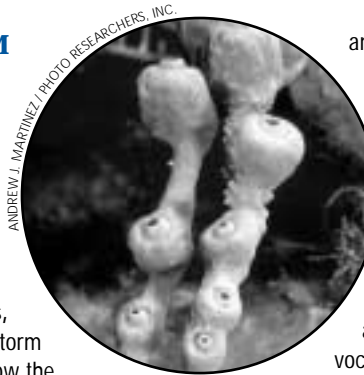
TRIUMPH OF LIFE
The Four Billion Year War

BROADCAST DATE: JANUARY 14, 2001

BEFORE VIEWING THE PROGRAM

Start by explaining that the theory of evolution says all the animals and plants in the world today developed from earlier, different species. As evidence for this theory, all species today share some characteristics with their ancient ancestors.

Write the names of the following groups of animals on the board: **mammals, fish, reptiles, amphibians, microbes**. Ask students to brainstorm a list of 2-3 animals for each group. Discuss how the animals in each group are related, what qualities they have in common. Then, based on the theory of evolution, ask students to figure out the sequence in which these animals appeared on Earth. [Based on fossil evidence, we know that these six groups evolved in the following order: microbes, fish,



ROPE SPONGE

amphibians, reptiles, mammals.] On the board, jot down some of the ways that each group may have been an evolutionary "improvement" over the group that came before it.

Distribute the Student Worksheet (Naturalist's Guide)

Photocopy and hand out the student worksheet (Naturalist's Guide) on the opposite page, and preview it with students.

As they watch the program, ask them to pay special attention to the role that genes, chromosomes, and DNA play in passing along traits from generation to generation. Review the vocabulary words (on the back cover) for this program with students. Also ask them to look for examples of animals that sacrifice their lives for the sake of their species.

AFTER VIEWING THE PROGRAM

Encourage students to discuss the program and share their observations. The following questions may be used for discussion.

- 1) What factors helped the first life appear on Earth 3.8 billion years ago?** (Over many millions of years, lava spewed into the oceans. Chemical reactions caused by lightning and ultraviolet radiation from the sun helped create an "organic soup" from which DNA was formed. Simple plants in the water released oxygen, which eventually formed Earth's ozone layer. This layer protected life from the sun's ultraviolet rays.)
- 2) Why do the skeletons of birds, whales, and turtles resemble each other?** (They share a common vertebrate ancestor that lived millions of years ago.)
- 3) When reptiles evolved from amphibians, what were some adaptations that helped them to survive on land?** (As reptiles gradually moved onto land, they developed new physical characteristics including tougher, waterproof skin and waterproof eggs. These changes enabled reptiles to breed in dry habitats.)
- 4) Besides physical appearance, what else do offspring inherit from their parents' genes?** (All animals inherit instincts, such as the urge to survive and the desire to produce offspring that will carry their genes.)

OBJECTIVES

Students will:

- discuss the role that genes, chromosomes, and DNA play in passing along traits from generation to generation
- understand the concept of biodiversity
- observe some fundamental similarities among animals
- compare and contrast groups of animals, including amphibians, reptiles, birds, and mammals

SUGGESTED RESOURCES

Books

Bennett, William, Chester E. Finn, Jr., and John T.E. Cribb, Jr. "Should Schools Teach Evolution?" *The Educated Child*, New York: Free Press, 1999.

Gamlin, Linda. *Eyewitness: Evolution*. New York: Dorling Kindersley, 2000.

Gonick, Larry and Mark Wheelis. *The Cartoon Guide to Genetics*. Toronto: Harper Perennial, 1991

Harris, Nicholas. *The Incredible Journey to the Beginning of Time*. New York: Peter Bedrick Books, 1998.

McCutcheon, Marc. *The Beast in You! Activities & Questions to Explore Evolution*, Charlotte, Vt.: Williamson Publishing, 1999.

Myers, Lynne Born. *Galapagos: Islands of Change*. New York: Hyperion Press, 1995.

Web Sites

A Handful of DNA
<http://www.thetech.org/hyper/genome/intro4.html>

DNA from the Beginning
<http://vector.cshl.org/dnaftb/>

Virtual Galapagos: Education Workbook
<http://www.terraquest.com/galapagos/education/index.html>

Great Events in Genetics (Timeline)
<http://www.hygirls.com/site/fun/genetics/line.html>

DNA: Instructional Manual for All Life
http://www.thetech.org/exhibits_events/online/genome/

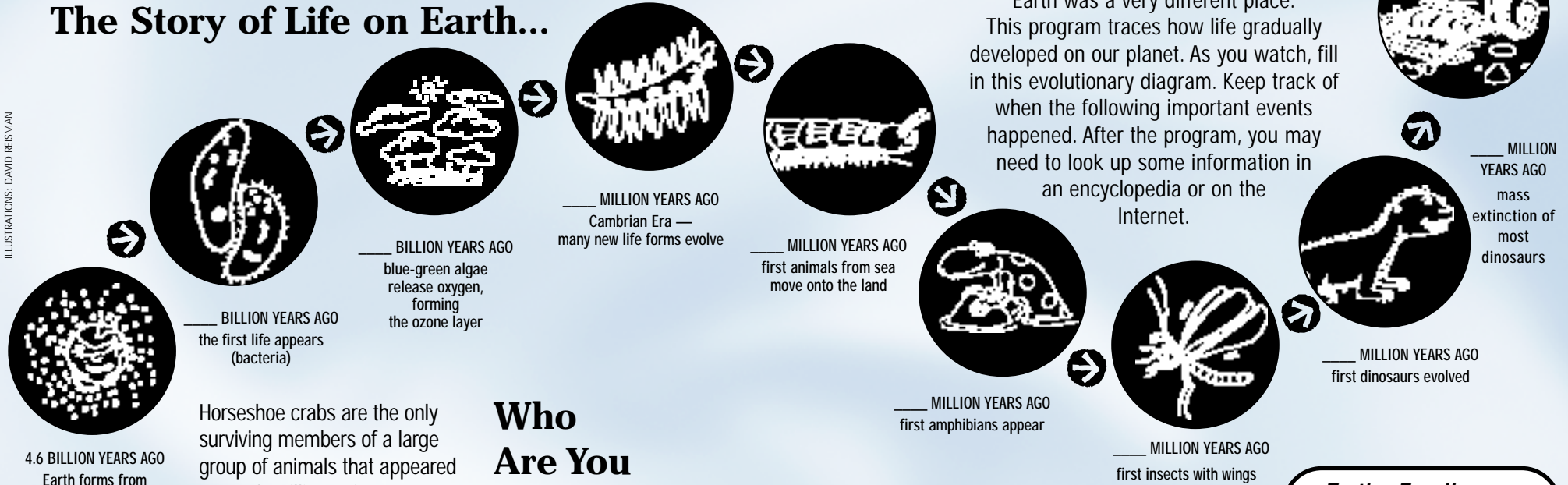
Explore Galapagos
<http://school.discovery.com/schooladventures/galapagos/index.html>

The Four Billion Year War

Complete the first activity and one other activity of your choice.

The Story of Life on Earth...

ILLUSTRATIONS: DAVID REISMAN



Four billion years ago, Earth was a very different place. This program traces how life gradually developed on our planet. As you watch, fill in this evolutionary diagram. Keep track of when the following important events happened. After the program, you may need to look up some information in an encyclopedia or on the Internet.

Horseshoe crabs are the only surviving members of a large group of animals that appeared on Earth millions of years ago. The closest living relatives of

these creatures are

scorpions and spiders. Horseshoe crabs today closely resemble their relatives from millions of years ago. Use library resources to find out more about this unusual species. How is its body organized? How does its tail help it steer, and turn its body over? Are horseshoe crabs related to trilobites? Which animals rely on horseshoe crab eggs for nourishment? What's the nearest location you'd be able to find a living horseshoe crab? Are horseshoe crabs dangerous or harmless to humans? Create a presentation for your class that shares your findings. Include labeled illustrations to clarify your points.

Who Are You Calling A Crab?

Going, Going...Gone

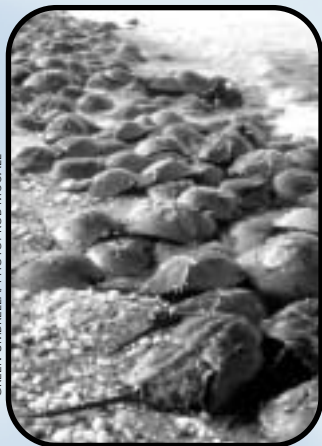
About 65 million years ago, a catastrophe happened on Earth that caused the widespread extinction of many plant and animal species, including most dinosaurs. (Some scientists today believe that modern birds are direct descendants of some dinosaurs.) Based on fossil evidence, we know there have been four other times in Earth's history where a large number of species have been wiped out. Research mass extinctions then write a report about one of them. Discuss how life on Earth might be different today if these extinctions had not occurred. In addition to dinosaurs, what other species disappeared due to a mass extinction (trilobites, for example)?

DID YOU KNOW? For 3 billion years, the most complex animals on earth were jellyfish. All the basic animals groups that are alive today evolved in "just" the last 530 million years.

To the Family...

You are invited to watch NATURE. After you watch this program, discuss some examples of genetic traits that have been passed along in your family (such as hair color, eye color, singing ability, and so on). If you'd like to learn more about genetics, you can visit this Web site:

http://www.thetech.org/exhibits_events/online/genome



HORSESHOE CRABS

© GREEN UMBRELLA/PHOTO: ROBI MCCALL

PROGRAM
overview

In asexually reproducing organisms, all the genes come from a single parent. Asexually produced offspring are usually genetically identical to the parent. In sexually reproducing organisms, however, the new individual receives half of the genetic information from its mother (via the egg), and half from its father (via the sperm). Sexually reproduced offspring resemble, but are not identical to, either of their parents. Mating and sexual reproduction help preserve biodiversity in the gene pool.

This program features the curious mating habits of lions, anacondas, geckos, wolf spiders, Apollo butterflies, and blue-footed boobies. In the pursuit of sexual reproduction, animals frequently exhibit bizarre behaviors. While the male redback spider mates, for example, he commits suicide by throwing himself into the jaws of the female. This odd sacrifice enables the male spider to pass along additional sperm while the female spider is distracted, as well as provide her with nutrients to help her offspring thrive. By sacrificing his own life, the male spider boosts the chances that his genes will be passed on to the next generation.

The evolution of sex has been the greatest breakthrough in the history of life. Male and female animals may have different agendas when they look for a mate, but their behavior often increases the likelihood that their offspring and descendants will survive in the future.

THEME: Animals will go to incredible lengths to pass on their genes to the next generation.

NATURE
Teacher's
Guide

TR I U M P H O F L I F E

The Mating Game

BROADCAST DATE: JANUARY 21, 2001

BEFORE VIEWING THE PROGRAM

Show your class a photograph of a peacock and point out its majestic fan. Then show a photograph of a female peafowl, which is called a peahen. Ask students to guess why the male of this species is physically much more eye-catching than the female. During courtship in order to attract the peahen, the peacock must spread his train and parade slowly in front of her. The more impressive his appearance, the more likely she'll mate with him. The elaborate tail is an ornament, a signal of the male's overall health. Both the male and the female want to pass along their genes to the next generation. Discuss what genes are (see Vocabulary on the back cover) and the role that they play in heredity.

Explain that in the program they'll be watching, they will see animals (such as sea anemones and geckos) that have the ability to reproduce by cloning rather than by sexual reproduction. While this form of reproduction may be convenient, it does pose some problems. Ask students to guess why. Then explain that the mixing of genes can be essential to the survival of a species. You can illustrate this point by discussing how certain breeds of dogs are "overbred." When related animals mate, the subsequent loss of genetic diversity can have detrimental effects. Some dogs that are overbred suffer from behavioral or health problems.

Distribute the Student Worksheet (Naturalist's Guide)

Photocopy and hand out the student worksheet (Naturalist's Guide) on the opposite page, and preview it with students. As they watch the program, ask them to look for different strategies that animals use to attract each other.

AFTER VIEWING THE PROGRAM

Encourage students to discuss the program and share their observations. The following questions may be used for discussion.

1) Compare the roles that male and female lions play in a pride.

(Female lions take care of the cubs and are responsible for hunting for food. The primary job of the stronger male lions is to protect the pride. The lions' genes drive these behaviors.)

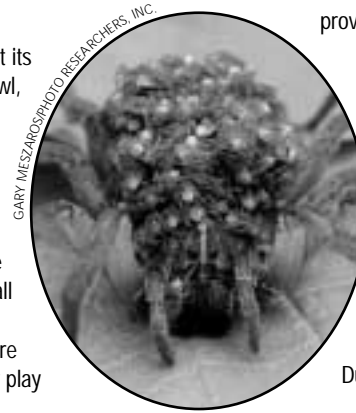
2) Why do male redback spiders commit suicide during mating?

(A male redback spider sacrifices his life in order to increase the chances that his genes will survive. While the female spider is focused on devouring the male's body, he has a few more seconds to mate. In addition, his body

provides nutrition for the female.)

3) For the gecko, what are the pros and cons of reproduction by cloning? (The obvious advantage is that the female gecko can produce offspring without having to attract a mate. The main drawback is that all her offspring have genes identical to hers. Since cloning does not involve mixing genes with another gecko, she risks the health of future generations.)

4) What's unusual about flatworm reproduction? (Unlike most animals, individual flatworms can produce both eggs and sperm. This means that any two flatworms can mate. During mating, one flatworm pierces the skin of the other with its sharp penis. All offspring will have the benefit of genes from both parent flatworms.)



WOLF SPIDER WITH BABIES

OBJECTIVES

Students will:

- identify strategies that animals use to pass on their genes to the next generation
- examine the different ways that male and female animals approach mating
- understand the evolutionary significance of the mating drive in animals

SUGGESTED RESOURCES

Books

Harrison, Kit and George Harrison. *Birds Do It, Too: The Amazing Sex Life of Birds*. Minocqua, Wis.: Willow Creek Press, 1997.

Sparks, John. *Battle of the Sexes: The Natural History of Sex*. New York: TV Books, 1999.

Web Sites

Geckos
<http://www.sazoo-aq.org/gecko.html>

Marine Iguana
<http://www.wwf.org/galapagos/lizard.htm>

Yellow Anaconda
http://www.rainforestsearch.com/rrrs/snk_ya.htm

The Mating Game

Complete the first activity and one other activity of your choice.

Mixing Genes

As you watch this program, fill in this chart which compares the ways different animals reproduce.

How Do These Animals Reproduce?

Species	Where do they live?	How does the male attract the female?	How do the females select a mate?
<i>Red-backed spiders</i>			
<i>Gecko</i>			
<i>Anaconda</i>			
<i>Wolf spider</i>			
<i>Blue-footed Boobies</i>			
<i>Apollo butterfly</i>			

Frogs Do It, Flies Do It

Animal mates have many unusual ways of finding each other. Female grasshoppers, bullfrogs, and toads are attracted to the calls made by males of their species. During breeding seasons, the female anaconda gives off a scent called a pheromone that attracts male anacondas. Female fireflies are attracted to male fireflies that flash their lights in a certain rhythmic pattern. Write and illustrate a report that describes and compares the ways different animals meet their mates.



PEACOCK FEATHERS

F. STUART WESTMORLAND/PHOTO RESEARCHERS, INC.

Survival Strategies

Visit a local park or pond and observe the wildlife there. Bring a small notebook so that you can record your observations. For each entry, write the date, the animals you watched, and the behaviors you noticed. Ask yourself: How do the behaviors I observed improve the animals' chances of survival? Look for some of the following: spiders spinning webs, squirrels gathering food or protecting their territory, birds building nests, pigeons trying to communicate with each other. Search, too, for animal tracks or nutshells. You may find it interesting to return to the same location at the same time every day.

Did you know?
The female kiwi's egg is about 1/5 of her entire body weight. In contrast, the male kiwi has millions of microscopic sperm.

To the Family...
You are invited to watch NATURE. After you watch this program, you may wish to discuss some of the "mating rituals" that male and female humans use to attract each other, such as flirting and primping.

overview

Approximately 500 million years ago, a genetic revolution took place. Before this time, most creatures were slow and relatively passive. Jellyfish, for example, didn't hunt their meals. Instead, they used their light-sensitive cells to float to the surface and then merely bumped into plankton. Then, over a period of millions of years, groups of cells gradually became organized into segmented bodies, and marine animals grew fins, eyes, and jaws. Evolution went into overdrive, and the number and variety of predators increased. This started an "arms race" between predator and prey. As predators got better at hunting, prey improved their ability to escape. As prey improve their defenses, predators upgraded their weaponry and offensive tactics.

"The Eternal Arms Race" shows how ongoing battles for survival have affected the speed of the cheetah and gazelle, the long neck of the giraffe and the height of the acacia tree, not to mention the curious glow-in-the-dark powers of the single-celled noctiluca. Other animals have developed the ability to change their coloring and texture to blend in with the background, or to imitate deadly predators. The genes in each generation are constantly tested in a never-ending struggle for survival.

THEME: The appearance and behavior of all plants and animals are shaped by the actions of other living things. Nothing evolves in isolation.

NATURE Teacher's Guide

TRIUMPH OF LIFE The Eternal Arms Race

BROADCAST DATE: JANUARY 28, 2001

BEFORE VIEWING THE PROGRAM

Show a picture of a giraffe and ask: If a female giraffe stretched her neck muscles every day, then gave birth to a baby giraffe, would the baby giraffe's neck be any longer than normal? Why or why not? It may help to offer an analogous human situation: If a person worked out at the gym every day, would that person's children inherit stronger muscles?

Today, we know that there is no evidence to support this theory. But during the 1800s, many people believed in Jean Baptiste de Lamarck's idea of "the inheritance of acquired characteristics."

Why is the giraffe's neck so long? Discuss: Do you think giraffes have always had such long necks? What do giraffes eat? Explain that giraffes eat the

leaves of the acacia tree. Millions of years ago, giraffes that happened to be born with slightly longer necks were able to reach leaves on acacia trees. Since these giraffes had more to eat, they produced healthier offspring. At the same time, taller acacia trees survived better than shorter acacia trees, so they were able to produce more offspring. Gradually, over millions of years, this competition caused the tallest acacias and the tallest giraffes to thrive.

Distribute the Student Worksheet (Naturalist's Guide)

Photocopy and hand out the student worksheet (Naturalist's Guide) on the opposite page, and preview it with students. As they watch the program, ask them to look for ways in which the appearance and behavior of all plants and animals are shaped by the actions of other living things.

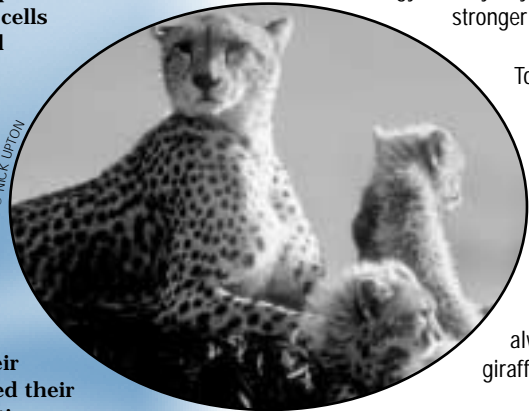
AFTER VIEWING THE PROGRAM

Encourage students to discuss the program and share their observations. The following questions may be used for discussion.

1) If cheetahs are the fastest land animals, why do gazelles frequently escape them? (While cheetahs can run swifter in a straight line for short distances, gazelles have the ability to turn quicker, and can keep up their speed over longer distances.)

2) Although an elephant's enormous size protects it from predators, what's a drawback of this feature? (Elephants require lots of energy to move around their bodies. This is why wild elephants usually need to eat for about 16 hours every day.)

3) Why does the Taricha newt have extremely toxic poison, even though it hunts only insects and other small animals? (This newt's poison is so strong to protect it from one of its predators, the garter snake. Every generation, as this kind of snake gets more resistant to the poison, the newt's poison, in turn, becomes more toxic.)



FAMILY OF CHEETAHS

OBJECTIVES

Students will:

- examine how plant and animal adaptations evolve as a result of changes in their environment
- observe how predators such as the wolf spider use strategy to hunt their prey
- analyze why prey use survival methods such as mimicry, camouflage, and feigning death to avoid predators

SUGGESTED RESOURCES

Books

Fredericks, Anthony D. *Clever Camouflagers*. Minnetonka, Minn.: Northword Press, 1997.

Gamlin, Linda. *Evolution (Eyewitness Series)*. New York: Dorling Kindersley, 2000.

Mullin, Rita T. *Who's for Dinner? Predators and Prey*. New York: Crown, 1998.

Parsons, Alexandra. *Amazing Poisonous Animals*. New York: Knopf, 1990.

Pearce, Querida L. *Great Predators of the Sea*. New York: Tor Books, 1999.

Web Sites

The Art of Camouflage (cross-curricular activity)
http://www.arts.ufl.edu/art/rt_room/sparkers/camouflage/camouflage.html

Noctiluca
<http://www.microscopyuk.org.uk/mag/art98/nocti.html>

Animal Adaptations Activity
<http://teacher.scholastic.com/dirtrep/animal/index.htm>

Colorful Warnings of Poisonous Animals
<http://members.aol.com/Art1234567/Poisonous.html>

The Portia and Other Weird Spiders
<http://sciencebulletins.amnh.org/biobulletin/biobulletin/story995.html>

The Eternal Arms Race

Complete the first activity and one other activity of your choice.

As Big As They Come

Some species have survived, in part, because of their large size. The bigger an animal is, the most difficult it is for other predators to eat it. The giant clam is about 4 feet long and weighs over 500 pounds. The Goliath frog is over 12 inches long and weighs over 7 pounds. Work with another student to research some other colossal creatures such as the anaconda, the Komodo dragon, the Kodiak bear, and the Goliath beetle.

The More, The Merrier

By hunting in groups, some predators are more successful in catching their prey than those that hunt alone. Use library resources or the Internet to find out more about such cooperative predation. For wolf strategies, see:

<http://www.wolfhaven.org/hunting.html>

Put your findings into a nature report. You may wish to draw some pictures to illustrate why group hunting by these creatures is more effective than if they hunted individually.

The Eyes Have It

Eyes play a critical role in helping predators hunt their prey. They also enable prey to escape their predators. Eyes have evolved in many varieties. Find pictures of different animal eyes from nature magazines, the newspaper, and the Internet. Mount each picture on a piece of cardboard. Then attach a piece of construction paper at the top of each board. Cut a hole in the paper so that only one of the animal's eyes is revealed. Write a clue about the animal on the front of the construction paper. Challenge other students to try to guess the animal based on just its eye and the clue. Afterward, you could donate your animal eye cards to a younger grade class.



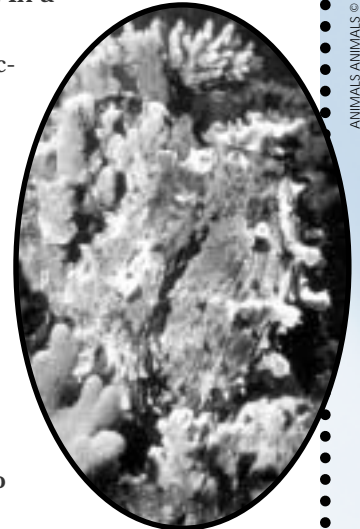
© GREEN UMBRELLA PHOTO: JON CLAY

ANACONDA



Did you know?

Found in the waters near Indonesia, the mimic octopus is a master impersonator. In a manner of seconds, this eight-armed wonder can transform its shape, color and texture to resemble a sea snake, a lionfish, or a jellyfish.



CAMOUFLAGED OCTOPUS

ANIMALS ANIMALS © CARL ROESSLER

To the Family...

You are invited to watch NATURE. After you watch this program, visit a local park and look for ways that animals have developed camouflage to blend it with their surroundings. At home, you might try creating paper snakes and coloring them so they blend in various places in your home. See if a younger sibling or friend can find them.

PROGRAM
overview

Unlike lone predators such as sharks, many animals rely on teamwork for survival. Through cooperation, these animals are able to hunt their prey, fend off predators, and build complex shelters. The meerkats in Africa, for example, live in underground colonies of up to 30 individuals. When these creatures hunt for food during the day, various duties are divided among the colony. Some meerkats are on the lookout for predators, such as eagles. Others devote their energy to gathering insects for their underground lair.

In a small number of animals, including bats, non-human primates, and humans, a more elaborate kind of cooperation has evolved, one based on trust. In the world of evolution, where passing on genes is the primary goal, helping non-relatives seems paradoxical. However, by assisting relatives and even friends to survive, helpers can continue the genetic line of their species without necessarily breeding themselves.

THEME: Some animal species collaborate in order to fight predators, hunt prey, and defend territory. Through teamwork, they have a better chance of passing some of their genes to future generations.

NATURE
Teacher's
Guide

T R I U M P H O F L I F E

Winning Teams

BROADCAST DATE: FEBRUARY 4, 2001

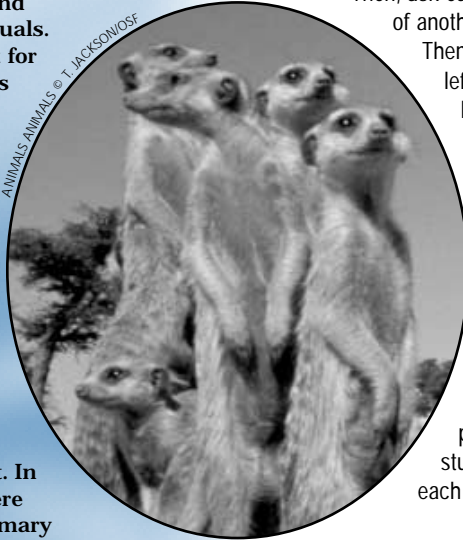
BEFORE VIEWING THE PROGRAM

Select six, eight, or ten student volunteers to create a "human knot."

Have these students form a circle with everyone facing the center.

Then, ask each student in the circle to grab the right hand of another person in the circle, using his/her right hand.

Then each student joins his or her left hand with the left hand of a different person. Once the "human knot" is complete, ask a student not participating in the knot to give the people in the knot instructions on how to untangle themselves without letting go of each other's hands. After a minute, ask the student to invite another student from the class to help solve this problem. Then after a bit, add another student to the "problem solving team." Continue until the "human knot" is untangled, or the students give up. Afterward, discuss whether it was easier to solve the problem individually, or with the help of other students. People have to take turns and listen to each other in order to get the job done.



MEERKATS

Explain that in the program "Winning Teams," students will

observe how animals such as ants, meerkats, and bats work together to survive.

Distribute the Student Worksheet (Naturalist's Guide)

Photocopy and hand out the student worksheet (Naturalist's Guide) on the opposite page, and preview it with students. As they watch the program, ask them to look for examples of how animals use teamwork to survive.

AFTER VIEWING THE PROGRAM

Encourage students to discuss the program and share their observations. The following questions may be used for discussion.

1) How do sea anemones cooperate in order to survive? (Sea anemones that live together share the same genes. Each sea anemone behaves as if it were part of one huge animal. Sea anemones that are located on the outer edge defend the colony, whereas those that live toward the center of the group are responsible for reproduction.)

2) How does the chimney of the termite's sand mound help the colony to breathe? (As termites breathe, carbon dioxide gas is released which escapes the mound through the chimney. If the air supply weren't constantly refreshed, the termites would die. The chimney also enables fresh oxygen to reach the underground chambers.)

3) When older booby chicks force younger chicks from the family nest, why don't the parent birds prevent this behavior? (The adult birds cannot easily feed two chicks. If the larger chick is strong enough to push the small one from the nest, it will likely survive, and the parents will only have to feed one. If something happens to the larger chick before it evicts the smaller one, then the smaller one is the family's "insurance.")

4) What are some human activities similar to bats caring for each other's young? (Humans care for each other's young in a number of contexts including babysitting and day care.)

OBJECTIVES

Students will:

- examine some diverse animal species that use cooperation for survival
- analyze the role of trust and cooperation in the human species
- compare and contrast cooperative behavior among different animals

SUGGESTED RESOURCES

Books

- Cerullo, Mary M. *Coral Reef*. New York: Dutton, 1996.
- Pascoe, Elaine. *Ants (Nature Close Up)*. Woodbridge, Conn.: Blackbirch, 1998.
- Pringle, Lawrence. *Bats! Strange and Wonderful*. Honesdale, Penn.: Boyds Mills, 2000.
- Reynolds, Jan. *Far North: Vanishing Cultures*. Orlando, Fla.: Harcourt Brace, 1992.

Taylor, Leighton. *Jellyfish*. Minneapolis: Lerner, 1998.

Tesar, Jenny. *What on Earth Is a Meerkat?* Woodbridge, Conn.: Blackbirch, 1997.

Walker, Sally M. *Sea Horses*. Minneapolis: Carolrhoda, 1999.

Wilsdon, Christina. *Insects (National Audubon Society First Field Guides)*. New York: Scholastic, 1998.

Web Sites

- Sea Anemones
<http://www.aqua.org/animals/species/pranem.html>
- Ant Colony
<http://www.antcolony.org/>
- Southern Ground Hornbill
<http://www.rhrwildlife.com/sgho.htm>
- Meerkats Information
<http://www.meerkats.net/>
- Bats 4 Kids
<http://members.aol.com/bats4kids/>

Winning Teams

Complete the first activity and one other activity of your choice.

Safety in Numbers

Here are some of the animals featured in this program.

- termites
- cheetahs
- titi monkeys
- spearnosed bats
- silversides
- reindeer
- wildebeest
- wild dogs
- mole rats
- ants

As you watch, take notes on how these animals use teamwork to help them survive. Then select three of these animal species. Use library resources or the Internet to create a report that identifies where each species lives, its diet, and its predators. Then compare the different ways these three species use cooperation to survive.



Ants can be fascinating to watch. To see for yourself how they cooperate to build their home and gather food, create your own ant farm.

For some tips on how to do this, check out this Web site:
Build an Ant Farm

<http://library.thinkquest.org/C004404/antfarm.htm>

If your class would like to buy an ant farm kit for this investigation, you can check your local pet store or contact

Insect Lore at 1-800-LIVE BUG
or visit their Web site

<http://www.insectlore.com/giantantfarm.html>

Dynamic Groups and Group Dynamics

This program states, "Trust is the currency of humanity." Work with another student to organize some team-building activities in your classroom. Each Friday for a month, find or create a different group activity that your class can try. After each activity, discuss what worked and what didn't. Have students write down the strategies that proved useful in tackling the cooperative challenges.

See if you can find one of these books, or others like it, in your library.

Jones, Alanna. *Team-Building Activities for Every Group*. Richland, Wash.: Rec Room, 1999.

Luvmour, Sambhava and Josette Luvmour. *Everyone Wins: Cooperative Games and Activities*. Gabriola Island, Canada: New Society, 1990.

Newstrom, John W. and Edward Scannell. *The Big Book of Team Building Games*. New York: McGraw-Hill, 1998.

Orlick, Terry. *The Cooperative Sports and Games Book: Challenge without Competition*. New York: Random House, 1978.

To the Family...

You are invited to watch NATURE. After you watch this program, think of examples of how cooperation plays an important role in human society. For example, during a natural disaster, such as a flood, hurricane, or earthquake, what are some ways that strangers help each other?

Did you know?

The queen termite produces an egg every 3-4 seconds. This is her full-time job for about 30 years!



KJELL B. SANDVED/PHOTO RESEARCHERS, INC.

overview

Sometimes the success of a species depends more on its intelligence than on its strength or speed. For example, although chimpanzees are primarily plant eaters, when they do hunt, they are twice as effective as lions at catching prey. This program investigates the notion of “survival of the smartest” and explores when and why brains evolved and what kinds of problems they enable animals to solve.

Jellyfish don't have any brain cells. Nor do they need them. These gelatinous sea creatures bump into their meals (plankton) with little effort. For jellyfish, muscle cells are more useful than brain cells. Predators, in contrast, must hunt their prey, which are often trying to escape. The more flexible and complex the thinking involved in the pursuit, the more brain cells will be required. In times of drought, the African elephant sometimes must rely on its acute sense of smell and outstanding memory to find a distant waterhole. The meerkat, too, has evolved a large brain because its survival depends on learning important lessons from its elders, such as knowing how to kill a scorpion.

The more social an animal is, the larger its brain needs to be. The program concludes by considering the elaborate brains of bats, dolphins and primates (including humans). These diverse animals are highly social and live in complex societies. Survival for these mammals depends on flexibility, strategy, and empathy.

THEME: Many animals rely on brainpower to survive. The more complex the challenges a species faces, the more sophisticated its brain.

NATURE Teacher's Guide

BEFORE VIEWING THE PROGRAM

Write the names of these animals on cards using big letters, and tape them to the board.

- POODLE
- GOOSE
- FROG
- ELEPHANT
- HONEY BEE
- CHIMPANZEE
- DOLPHIN
- BAT

Ask two students to take turns arranging the animal cards in order from least intelligent to most intelligent. Ask the class to discuss if they agree with the proposed order. Have a discussion about what it means for an animal to be “intelligent.” What behaviors can more intelligent animals do that less intelligent animals cannot? (examples: ability to learn and the ability to solve difficult problems). Ask students to discuss: Are humans the most intelligent animals? Why or why not?

Distribute the Student Worksheet (Naturalist's Guide)

Photocopy and hand out the student worksheet (Naturalist's Guide) on the opposite page, and preview it with students. As they watch the program, ask them to look for examples of how brainpower gives some species greater flexibility when solving problems. In particular, compare the ways that the goose and the ostrich deal with foreign objects in their nests.

AFTER VIEWING THE PROGRAM

Encourage students to discuss the program and share their observations. The following questions may be used for discussion.

1. What are two reasons that elephants need such large brains?

(In times of drought, elephants must be able to find water to survive. The eldest member of an elephant herd uses its brainpower to recall the location of a possible water source, and then uses its incredible sense of smell to track it down. Elephants also need large brains to help them negotiate the complexities of the elephant society in which they live.)

2. How does the honeybee's brain change near the end of its life?

(During the last two weeks of a bee's life, its brain grows an extra 160,000 brain cells. This extra “brain power” is necessary to help it collect nectar. In order to recognize the

Brain Power

BROADCAST DATE: FEBRUARY 11, 2001

positions of a wide assortment of flowers and know the time of day when their nectar is accessible, the bee must keep track of a great deal of seemingly random information.)

3. If “brain power” is such a useful survival tool, why haven't all animal species developed it? (A brain's nerve cells consume a great deal of energy — twenty times more energy than muscle cells. In nature, limited food resources and tough competition cause animal species to evolve only the tools they need. If a species can survive with fewer brain cells, it will.)

4) Besides physical appearance, what else do offspring inherit from their parents' genes? (All animals inherit instincts, such as the urge to survive and the desire to produce offspring that will carry their genes.)

4. Why are the ostrich's powers of visual discrimination more astute than the goose's? (A mother goose sits on her own eggs, so visual discrimination among different goose eggs isn't necessary. In fact, having the brainpower to see subtle differences among eggs would be a waste of this goose's energy. Ostriches, on the other hand, have communal nests. If too many other ostriches' eggs are put in her nest, she needs to be able to recognize her own eggs so she can give them the best chance of survival.)

5. If humans hadn't developed the ability to talk with one another, how might our lives be different? (Open-ended discussion)

OBJECTIVES

Students will:

- compare the cognitive abilities of different animal species
- examine the ways in which brain complexity is influenced by the challenges a species faces
- discuss the role that conversation plays in human societies

SUGGESTED RESOURCES

Books

Funston, Sylvia. *Animal Smarts*. Toronto: Owl Books, 1997.

Parker, Steve. *Brain and Nerves (Look at Your Body)*. Brookfield, Conn.: Copper Beech Books, 1998.

Pascoe, Elaine. *Animal Intelligence: Why Is This*

Dolphin Smiling? Woodbridge, Conn.: Blackbirch, 1998.

Demoss, Robert T. *Brain Waves Through Time: 12 Principles for Understanding the Evolution of the Human Brain and Man's Behavior*, Cambridge, Mass.: Perseus, 1999.

Web Sites

Animal Intelligence
<http://www.pethelp.net/cognit.html>

Inside the Animal Mind
<http://www.pbs.org/wnet/nature/animalmind>

Orangutan I.Q.
<http://www.pbs.org/wnet/nature/orangutans/iq.html>

Comparative Mammalian Brain Collections
<http://www.physiology.wisc.edu/brain/>

Poject Koko
<http://www.koko.org>

Brain Power

Complete the first activity and one other activity of your choice.

Monkey Business

As you watch this program, look for examples of how primates such as chimpanzees, macaque monkeys, and gelada monkeys communicate with each other. Scientists in the field make detailed notes about observations in nature. In a notebook or on the back of this page, write your notes about these questions:

- ▶ **What are some ways that these monkeys communicate with each other?**
- ▶ **What role does grooming play in their social lives?**
- ▶ **How do chimps use strategy when hunting?**
- ▶ **How does primate "conversation" help contain aggression?**



Did you know?
In the 1970s, Stanford University researchers began teaching American Sign Language to a female gorilla named Koko. So far, she's mastered more than 1,000 words and can use these signs to communicate.

Bee Brains

In the last two weeks of their life, honeybees emerge from their hive to gather nectar for the colony. This is not as easy as it sounds. Bees keep a mental record of the flowers they have visited, and note the precise location of each flower and the sun's position when each flower is open. Using library resources or the Web, research and write a report about how bees find nectar and communicate where it is to other bees.



HONEY BEE

How Smart is that Doggie in the Window?



Observe the behavior of a household pet, such as a dog, cat, fish, bird, or turtle. Do you consider the pet intelligent? Why or why not? Write an essay that explains your position. Include examples to illustrate your points. You may wish to try developing an "animal intelligence" test that could be used with a parrot, and another that could evaluate dog intelligence.

To the Family...
You are invited to watch NATURE. After you watch this program, create a list of ten animals that you think are most intelligent, and a list of ten animals that you consider least intelligent. Discuss your choices.

PROGRAM
overview

The story of life is also the story of extinction. While this may sound extreme, bear in mind that more animals have become extinct over the last 4 billion years than are currently living on our planet. Many people are familiar with the mass extinction 65 million years ago that wiped out many creatures, including all the large dinosaurs. But this is hardly the only time our planet's life has experienced such upheaval. Based on the fossil record, paleontologists and geologists have deduced there have been five mass extinctions.

Some animal species have managed to survive one or more mass extinctions. Sharks and cockroaches, for example, were around long before the first dinosaurs arrived on the scene. Although most dinosaurs vanished at the end of the Cretaceous era, small furry shrew-like creatures endured and evolved into every mammal known today, including humans.

Why do some species survive while others become extinct? To explore this fascinating question, this program considers a variety of contemporary wildlife. Animals that are resourceful have a better chance of coping with a changing world; those that are less flexible are more vulnerable to dying out. Crocodiles are superb survivors because they are not fussy eaters, have a population that has spread around the globe, and can live underwater if conditions on land become too harsh. On the other hand, pandas are extremely specialized and particular about their diet. They eat bamboo leaves or nothing. Some predator-prey relationships are so dependent that if either animal were to disappear, the ecosystem could be seriously affected.

THEME: The true test of a species' future is how it copes in a changing world.

NATURE
Teacher's
Guide

T R I U M P H O F L I F E

The Survivors

BROADCAST DATE: FEBRUARY 18, 2001

BEFORE VIEWING THE PROGRAM

Review what the term "extinction" means (the situation when the last member of a species dies). Then explain the term "mass extinction" (when vast numbers of species become extinct at the same time.) Ask students to guess how many mass extinctions there have been on Earth in its 4.6 billion year history. After considering all suggestions, explain that scientists have determined that there have been five mass extinctions. (Note: These five eras are labeled on the student handout on the opposite page.) Students are probably most familiar with the mass extinction that occurred roughly 65 million years ago. This is the time when most dinosaurs were wiped out. (We say "most dinosaurs" because many scientists believe that modern birds are descended from a small group of ancient dinosaurs.) Ask students:

- **Since humans have only been around for less than two million years, how do we know about animals that lived billions of years ago?** (Answer: fossils)
- **How long did the mass extinction of dinosaurs take?** (Answer: We don't know. But it certainly didn't occur overnight. Scientists speculate that mass extinctions in the oceans were gradual, taking thousands, and sometimes even millions, of years.)

Distribute the Student Worksheet (Naturalist's Guide)

Photocopy and hand out the student worksheet (Naturalist's Guide) on the opposite page, and preview it with students. As they watch the program, ask students to think about why certain animals have survived while others have become extinct.

AFTER VIEWING THE PROGRAM

Encourage students to discuss the program and share their observations. The following questions may be used for discussion.

- 1) **If adaptability is a key to survival, why have some successful ancient creatures, such as crocodiles and sharks, remained the same for millions of years?** (Animals



TRILOBITE

that are successful and flexible predators have less of a need to adapt to changes in the environment. The less closely linked an animal is to a particular prey, the greater its chances for long-term survival.)

- 2) **Why are animals that live on isolated islands more likely to become extinct than those living in much larger areas?** (Animal species that live on islands have often evolved simpler systems for survival. If you make one change to their environment, it may cause a major disruption.)

- 3) **What are some of the problems caused by invasive or thoughtlessly introduced plants and animals in the United States?**

(New species with no natural enemies can threaten native species. Examples include melaleuca trees from Australia that are crowding out native plant life in Florida and Asiatic longhorn beetles that are threatening maples in the northeast.)

- 4) **Earth's forests have been reduced to 1/10 their original area. Half the species they once held are already lost. Do you think this the beginning of the sixth mass extinction? Why or why not? Where could it lead? Can we adapt?** (Open-ended discussion with supporting evidence from the program)

OBJECTIVES

Students will:

- understand what a mass extinction is
- speculate on why some animals have survived mass extinctions, while others have not
- understand why isolated species, such as those on an island, are more susceptible to the forces of extinction

SUGGESTED RESOURCES

Books

Feeney, Kathy. *Pandas for Kids*. Minnetonka, Minn.: Northword Press, 1997.

Hoff, Mary King. *Our Endangered Planet: Life on Land*. Minneapolis: Lerner Publications, 1992.

Lessem, Don. *Dinosaurs to Dodos: An Encyclopedia of Extinct Animals*. New York: Scholastic, 1999.

Web Sites

BBC: The Extinction Files
<http://www.bbc.co.uk/education/darwin/exfiles/index.htm>

Endangered Species of the Next Millennium
<http://library.thinkquest.org/25014/>

Endangered Species Program (U.S. Fish and Wildlife)
<http://endangered.fws.gov/>

Great Events in Genetics (Timeline)
<http://www.hygirls.com/site/fun/genetics/line.html>

Dodo
<http://www.amnh.org/Exhibition/Expedition/Treasures/Dodo/dodo.html>

The African Wild Dog [endangered]
http://www.botany.uwc.ac.za/Envfacts/facts/african_dog.htm

NATIONAL SCIENCE EDUCATION STANDARD: This program can help students understand the environmental and adaptive factors that may lead to extinction.

The Survivors

Complete the first activity and one other activity of your choice.

Next Stop...The Sixth Mass Extinction?!

ERA	NUMBER OF YEARS AGO	% OF ANIMALS EXTINCT	WHAT BECAME EXTINCT
Ordovician	About 438 million years ago	20-50% of animal families	marine organisms
Devonian	About 360 million years ago	30% of animal families	marine organisms
Permian	About 245 million years ago	about 50% of all animal families, and 96% of all species — greatest mass extinction in history	marine organisms
Triassic	About 208 million years ago	35% of animal families	trilobites & brachiopods
Cretaceous	About 65 million years ago	about 76% of all species	dinosaurs & flying reptiles

Above is a chart that lists the five "mass extinctions." These were times when natural catastrophes, such as asteroid crashes or massive volcanic activity, caused many species to become extinct. About 250 million years ago, more than 95% of plants and animals vanished, making way for the dinosaurs. Some scientists believe that we're at the start of a sixth mass extinction. This extinction is largely due to human actions that have altered the planet's biodiversity. Write a brief report that answers the following questions: If only 10% of species survived, which animals do you think would continue to the next era? Why?

To the Family... You are invited to watch NATURE. After you watch this program, you may wish to visit a local science museum to observe fossils of extinct animals that lived in your area millions of years ago.

These materials were made possible by Park Foundation, Canon U.S.A., Inc., Ford Motor Company and TIAA-CREF.

Gone...But Not Forgotten

More animals have become extinct over the last 4 billion years than are currently living on our planet. Work with a small group of students to paint a mural for your classroom that presents at least 20 animals that once lived on Earth. Next to each animal, write a short paragraph explaining the leading theory for why this species became extinct. If you wish, you may add a section about endangered animals that are likely become extinct in the next 1,000 years. You may find the following Web site helpful:

Endangered Species of the Next Millennium
<http://library.thinkquest.org/25014/>



STEGOSAURUS FOSSIL

F. GOHER/PHOTO RESEARCHERS, INC.



GIANT PANDA

TOM & PAT LEESON/PHOTO RESEARCHERS, INC.

Fussy Feeders

Some animals have evolved to eat a highly specific diet. Pandas eat only bamboo, aardvarks only devour termites, and the cheetah's dinner is always gazelle. Use library resources or the Internet to help you research at least six animals that are "fussy eaters." Create a poster that describes where each animal lives, and how it gets its food. On a section of the poster, speculate on what would happen if these animals' food supply were to suddenly disappear.

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V O C A B U L A R Y

The Four Billion Year War

adaptation the process by which an individual animal or species changes in response to its changing environment.

amphibians cold-blooded vertebrates, such as a frogs or salamanders, that can breathe under water as larvae, and then develop lungs as adults.

biodiversity the variety of life that exists among animals and plants. Scientists usually distinguish three levels of biological diversity: genetic, species and ecosystem.

chromosomes rod-like structures found in cells. Humans have 46 chromosomes. The units of inheritance (genes) are found along chromosomes.

DNA (deoxyribonucleic acid) the molecule that carries genetic information for all living things. Chromosomes are mostly made of DNA.

evolution the theory that all plants and animals gradually adapt to their environment over great spans of time.

genes the basic units of heredity found on chromosomes. Genes tell the cell what to do, how to do it and when to do it. Scientists estimate that humans have approximately 100,000 genes.

natural selection Charles Darwin's theory that plant and animal species that are best adapted to a particular environment will produce more offspring over time.

vertebrates animals that have backbones, including fish, reptiles, amphibians, birds and mammals. There are about 43,000 kinds of vertebrates, about half of which are fish.

The Mating Game

clones two or more organisms that share the same DNA (hereditary material). Identical twins are natural human clones.

hermaphrodite an animal or plant that has both male and female reproductive organs.

sexual reproduction in this method of reproduction, an animal receives half of the genetic information from its mother (via the egg) and half from its father (via the sperm).

The Eternal Arms Race

camouflage a form of visual deception by which animals can elude predators

mimicry an organism's ability to closely resemble its surroundings or another animal or plant, such that predators or prey are easily confused.

predator an animal that hunts, kills and eats other animals for food

prey an animal that is hunted or seized for food by another animal.

Winning Teams

altruism self-sacrificing behavior that benefits another animal or group.

colony a large group of related animals, such as ant colonies.

instinct an inborn tendency to behave in a certain way.

sibling a brother or sister

teamwork when a group works together to complete a goal.

tuber a thick, enlarged part of a stem that grows underground, such as potato.

Brain Power

alliance an agreement in a group for its members to support one another.

anesthetic a substance that causes partial or total loss of feeling (vampire bats

NATURE SCHEDULE January-March, 2001

TRIUMPH OF LIFE: The Four Billion Year War ... January 14, 2001

TRIUMPH OF LIFE: The Mating Game ... January 21, 2001

TRIUMPH OF LIFE: The Eternal Arms Race ... January 28, 2001

TRIUMPH OF LIFE: Winning Teams ... February 4, 2001

TRIUMPH OF LIFE: Brain Power ... February 11, 2001

TRIUMPH OF LIFE: The Survivors ... February 18, 2001

Cheetahs in a Hot Spot ... February 25, 2001

Baby, You're So Cute (working title) ... March 4, 2001

Jane Goodall's Wild Chimpanzees ... March 11, 2001

Extraordinary Dogs ... March 18, 2001

American Buffalo: Spirit of a Nation ... March 25, 2001

inject a natural anesthetic when drawing blood from a cow).

carnivore a meat-eating animal.

intelligence the ability to learn and to solve problems.

The Survivors

crustaceans a group of animals, mostly aquatic, that have hard shells and jointed bodies, e.g. crabs, lobsters and shrimp.

descendants offspring that share a common ancestor. For example, all humans are descendants of the first mammal.

era one of the five very large periods of time in geological history, such as the Mesozoic Era.

mass extinction when many species become extinct around the same period of time.

strata plural of stratum. A stratum is a layer of rock containing material from the same time period.

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